SEA-SIDE WATER

AN EXAMINATION INTO THE CHARACTER OF

THE WATER SUPPLY AT THE WATERING-PLACES OF ENGLAND AND WALES

ABSTRACTED FROM A SERIES OF REPORTS PREPARED FOR AND PUBLISHED IN 'THE SANITARY RECORD' DURING 1877-8

BY

G. W. WIGNER, F.C.S.

ONE OF THE HONORARY SECRETARIES OF THE SOCIETY OF PUBLIC ANALYSTS
PUBLIC ANALYST FOR GREENWICH, PLUMSTEAD, AND WOOLWICH DISTRICTS

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INTRODUCTION.

Sanitary Science, which may not inaptly be described as the science of keeping in health, now takes rapid strides. A few years ago the systematic analysis of the water supply of various towns would have been looked upon as entirely unnecessary, and, except as regards London, Glasgow, and Birmingham, no statistics as to the purity or impurity of a public water supply were available for general information. The Rivers Pollution Commissioners did something to remedy this state of things, but the examinations which they made were published in such an expensive and (to the general reader) unintelligible form, that but little good was done by them.

The proprietors of the 'Sanitary Record,' seeing the necessity for further information on this important subject, decided to take the bold step of investigating the character of the water supply at all the sea-side watering places in England and Wales. They commissioned me to undertake the analyses of the samples for them, and the reports which are just completed are probably the most extensive series of water analyses ever published except in a Blue Book.

The publication of the results of the inquiry has extended over nearly eight months, and in consequence, although those who take a special interest in any particular place, have in most cases been able to obtain a copy of the report referring to that place: it has for a long time been impossible to obtain a complete series of the reports. It has therefore been considered desirable to republish all the principal analyses, and an abstract of the literary matter in a more compact form, and this small book is the result of that decision. In order to render it more readily available as a book of reference, an alphabetical arrangement of the places referred to has been substituted for the geographical arrangement which was adopted in the original reports, and the figures of the analyses have been tabulated, instead of printing each analysis in con-

nection with the report on the place to which it refers. This renders reference to any place more easy by the removal of the large bulk of tabulated matter to the end.

The samples from about ninety of the places reported on were procured by my own assistants, who took the greatest care to ensure that, as far as possible, every sample, when the supply was a public one, came direct from a main. In a few cases the samples were forwarded to me by officials or persons of position upon whom I could rely in the place in question, while in some other cases a visitor to some small place almost overlooked, sent me a sample of the water in use.

As to the analyses themselves, the tabulated results show that they are complete. No precaution was omitted which could give assistance in the formation of a satisfactory opinion.

The valuation of the impurities present in the samples is made by means of a Valuation Scale, which I submitted some months since to the Society of Public Analysts, and which has been published in the 'Sanitary Record,' and the 'Analyst.' This scale provides for the due consideration of every figure or result obtained in the course of a water analysis. From this valuation the classification is deduced, which is made on such a basis that the London water supplies will all pass just within the limit of first-class water. It is therefore lenient, and I consider it wiser that it should be so. Those places supplied with water, which according to this scale ranks as third-class, should be avoided by visitors, and those waters which rank as bad third-class are dangerous to drink.

The summary at the end of the book gives a concise and complete view of the general character of the water supply on the English and Welsh coasts. Some points in this are worth serious consideration as a matter of national policy.

If this pamphlet, abstracted as it necessarily is, leads to a more thorough appreciation of the evils to be feared from impure water, I shall not have written in vain.

G. W. WIGNER.

Laboratory, 79 Great Tower Street, London:
July 1878.

SEA-SIDE WATER.

ABERGELE is a small town in Denbighshire, at a short distance from Rhyl, with a population of about 3,200. It has a constant supply of water from the Llanivydd Water Works, which also supply Rhyl, St. Asaph, Rhuddlan, and Pensarn. The water is collected from a gathering ground of a little over a thousand acres and stored in a large reservoir, and thence carried through a series of five settling tanks into another reservoir, from which it passes into a filter bed. Owing to the presence of a small quantity of peat on the gathering grounds, the water is sometimes contaminated with vegetable matter, and hence it is very seldom pure enough to rank as a really first-class water, although it is generally on the border line between first and second class. Judging from my sample, its advantages are that it is extremely soft, and does not appear to be in any way contaminated by animal impurities. On the other hand, the peaty matter gives it at times a somewhat objectionable colour, and occasionally a slight smell. There are still, unfortunately, some private wells and springs in use: it would not be fair to condemn all these wells from the sample of the one I analysed, but this was of such an extremely bad character that it would be very undesirable for visitors to Abergele to stay at any house supplied with well or spring water, unless that water had been first analysed and ascertained to be fit for use. The degree of contamination, in my sample, was such as to make it class as bad sewage.

ABERYSTWITH, in Cardiganshire, has a population of about 7,000, and during the season probably as many visitors. The water supply during last year was in an unsatisfactory condition, probably owing to neglect on the part of the local authorities. About the time my sample was drawn from the mains in the town, it was reported that some one (for some reason unknown) had knocked a hole in the pipe which conveyed the water from the springs, and that in consequence a considerable proportion of dirty water had been allowed to pass down the pipes with the clear water. Most probably this accident (?) had

arisen from a dispute at the town council as to the source from which the supply should be drawn. I therefore procured an additional sample from Simon's well, which was said to be the source actually decided upon by the town council, and I examined both samples. The sample from the mains was soft and comparatively free from saline matter; the albuminoid ammonia, which is such an important figure in water analysis, was low. There was, however, distinct evidence of great contamination by vegetable matter. The chemical results of the sample from Simon's well were superior to those of the previous sample, although it did not even then rank as first class. I have not yet received any information as to whether the main has been relaid; but, unless that has been done, the supply is not a trustworthy one.

ALDEBURGH, in Suffolk, is a small place, with a population of about 2000. It is partly supplied by a water company who are said to give a constant service. The analysis of my sample showed that it was an extremely impure water: it contained at least three times as much solid matter as should be present, and this consisted partly of an admixture of an excessive quantity of common salt; the water was also heavily contaminated with organic matter. It would be unsafe for any visitors to drink this water without filtration. Some of the inhabitants of the town are supplied by private wells, and some from a pump known as the public pump. The sample which I examined of the water from this pump was not quite as bad as the public supply, but still it was a grossly impure water; it swarmed with living animalculæ, and contained animal remains in addition. Filtration through a good charcoal filter would be absolutely necessary to render this water safe to drink.

ALUM BAY is a small, but pleasant place in the west of the Isle of Wight. There is no public supply, strictly so called, but a spring has been tapped by some of the inhabitants, and pipes laid down, to supply the hotels and a few of the houses. The sample I obtained was a very satisfactory illustration of a first-class private supply. The water was a little hard and slightly saline, perhaps from the spray carried up from the sea; but with these exceptions no fault whatever could be found with it.

BANGOR, in Carnarvonshire, has a population of about 8,000. It is said to have an intermittent supply of water, derived from springs at Aber. My sample was of a most satisfactory character; the total value of the impurities, calculated according to the valuation scale, was less than the usual valuation of the best of the London waters. It was soft, and very free from nitrogenous impurities. It is said that a few of the inhabitants use the water from Ogwen Lake and Glanrafon Spring; the former is decidedly an objectionable water, as my sample contained

traces of copper, and it is obviously undesirable that any water containing even a small quantity of a poisonous metal should be used for drinking purposes. The sample I had from Glanrafon Spring was of excellent quality, and on the whole slightly superior to the public supply. It may safely be used by those who prefer it.

BARMOUTH, in Merionethshire, has a population of about 1,200, and probably about 1,800 or 2,000 visitors. There is a constant public supply of water, which is obtained from a well issuing out of a rocky mountain. It is said that rainfall makes no difference in the supply from the well. The supply is ample, being at the rate of twenty gallons per head per day. The analysis of the sample which I examined was very satisfactory, and showed that it was one of the best waters on the coast.

BEAUMARIS, in Anglesey, is another small place, with about 2,000 inhabitants, and probably about as many visitors. I was unable to obtain any official information, but I was unofficially informed that there is a public supply which is collected from rock springs, and flows by gravitation into the town. I could not ascertain whether this supply is furnished to all the houses; but whether it is so or not, many of them have independent springs. A sample of the public supply proved to be of satisfactory quality; it was soft, and the nitrogenous constituents were low. It ranked amongst the best of the first-class waters. A sample obtained from an independent spring which is used at an hotel was also of good character, very little worse than the public supply, and considerably superior to the best of the London supplies. If, as I hope was the case, this fairly represented the character of the independent springs, there is really no need for the extension of the public supply, and Beaumaris may be congratulated on having two such satisfactory sources of water to choose from.

BIRKDALE, in Lancashire, is a suburb of Southport, and is supplied with water from the Southport mains. There is a constant supply to a great part of Southport, but I was not informed whether it is constant at Birkdale. The water is obtained from the hills at Ormskirk and Scarisbrick. The character of my sample was quite satisfactory; it contained rather more solid matter than the last few waters to which I have referred, and there was also a slight increase in the organic matter volatilised on ignition, but the other features of the water were so satisfactory that it was impossible to remove it from the first-class table.

BLACKPOOL, also in Lancashire, has a normal population of about 6,000. The North and South Shores are separately supplied with water from two springs in the hills at the back of the town, both of which are the property of the Fylde Waterworks Company, who also supply Lytham and other parts of that district. At the time my samples were taken

the Company were said to be labouring under difficulties, as the reservoir at Grizedale, which supplies the North Shore, was leaky, and was at that time quite empty. The Company were not only repairing that reservoir, but putting in a new one, which they expected would catch a more pure water. These circumstances may account for the unsatisfactory character of the two samples I analysed. The North Shore sample was of an almost opaque yellow colour, the opacity being due to a large quantity of suspended matter; the South Shore sample was free from suspended matter, but the colour was a still more marked yellow. This yellow colour is almost always indicative of contamination with peaty matters, and the microscopical examination of these samples confirmed this supposition by showing that there was a very large quantity of vegetable matter present, which ought to have been removed by filtration. Both samples were alike in having a slight smell and taste, due to the presence of this peat, and both showed a considerable number of bacteria. At this date, therefore, the water supply of Blackpool was in a very unsatisfactory condition; but it is only fair to the Company to say that they expected by the middle of this year to have the new reservoir completed and to furnish a better supply.

Later on, in 1877, while these series of analyses were in progress, I had a sample from St. Anne's, which I believe is supplied by the same Company with water obtained from the same gathering ground. This latter sample was decidedly superior to those from Blackpool, and therefore indicates that the company were making efforts to remedy the objectionable state of things referred to above.

BOGNOR, in Sussex, is a small place, with a population of about 3,000. It is said that some time ago a company was formed to supply the town with water, but the company were unsuccessful, and consequently the town is still supplied by private wells only. I obtained two samples, one from an hotel, and one from a private house. The hotel sample contained a considerable proportion of salt, and was excessively hard—in fact, one of the hardest waters I have seen; it also contained a large proportion of nitrogen as nitrates, indicative of previous sewage contamination, and the microscope showed that the water was full of living animalculæ and other organic impurities. The sample ranks as a bad third-class water, quite unfit for use without filtration. The sample from the house contained less solid matter, and was rather softer, but the albuminoid ammonia, which is the principal indication of recent sewage contamination, was so high as to show at once that the water was unfit to drink. The microscope showed decomposing muscular fibre, and other organic remains. This water, although in the third class, is so low down in the class, that sewage would be the more correct term for it. It will not be wise for visitors to drink the water from any well

in Bognor, unless it has been previously analysed and found to be more pure than the two samples I examined.

BRIDLINGTON, in Yorkshire, has a population of about 7,000, and is supplied with water by a company, who obtain it from two wells in the chalk. There is a constant supply, but it only amounts to about fourteen gallons per head per day, which would be insufficient for the proper supply of the town, if it were not for the fact that most of the inhabitants have private wells in addition. My first sample of the town supply was fairly good, though not sufficiently so to enable me to rank it as first class. It contained a large amount of suspended matter, consisting partly of chalk and partly of vegetable impurities. The company do not filter the water; if they did, all this suspended matter would be removed, and the water would then probably rank as first class. I subsequently received another sample of the company's water, which was entirely free from suspended matter.

I also examined a sample from one of the private wells, and the most objectionable features in this were that there was a slight smell and taste. The suspended matter was less in quantity than in the public supply. It is a good second-class water.

BRIGHTON has a population of about 130,000, and the number of visitors is probably larger than to any other place on the south coast, or perhaps in the kingdom. It is supplied with water from waterworks which are the property of the corporation, and in one respect the supply is unique, as in most of the streets there is a double set of mains, one being constantly charged at high pressure, and the other used for an intermittent supply from six till eleven every morning. It rests with the householders to elect which supply they take. Intending visitors, therefore, will do well to inquire at the house at which they propose staying, whether water is laid on from the constant or intermittent supply. I had two samples drawn at some six weeks interval: both showed a moderate proportion of solid matter, and were fairly soft—softer, in fact, than the greater part of the London supplies, and they were tolerably free from nitrogenous matters. The supply, as a whole, was very satisfactory, and ranked among the best of the first-class supplies.

BRIXHAM, in Devonshire, has a population of about 5,000; the supply is derived from a spring called Laywell, situate at Higher Brixham, and the quantity furnished is nearly thirty gallons per head per day. The supply is constant, but unfortunately it is not filtered: this is a pity, because the faults of the water are almost all due to the neglect of this filtration. The chemical results possessed no features of special interest, and on the whole, notwithstanding the want of filtration, the water was just on the margin line between first and second class.

BROADSTAIRS, in Kent, has a population of 2,000, increasing during the season to 5,000 or 6,000. The water is derived from two wells in the chalk, one of which is near the town and the other near to St. Peter's. Unfortunately the former, the water from which is the least pure, furnishes by far the most abundant supply. The service in the town is constant, and the quantity is estimated at twenty gallons per head per day. The water supply for some time previous to the autumn of 1877 had been in a very unsatisfactory condition. The microscopical examination of my sample, drawn in 1877, showed a large number of living organisms and a few small particles of animal débris. The amount of nitrates was also greatly in excess of that found in the unpolluted wells of the district. I think there is no doubt that the water from the new well is better in quality; but this well does not appear to furnish a sufficient supply, so that the waters from the two wells are mixed for distribution through the town. The valuation of the water was so high as to bring it to the very bottom of the second class—that is, it contained twice as much impurity as the worst of the London waters.

CARNARVON, in Wales, has a population of about 10,000, and comparatively few visitors; the water supply is constant and is derived from Quellyn lake at the bottom of Snowdon. As regards the quantity of mineral constituents present, the water was very pure, ranking in this respect very close to the Loch Katrine water, with which Glasgow is supplied. The nitrogenous compounds were also low and the microscopical examination was perfectly satisfactory. The great objection to it however as a water supply was, that it contained small but very distinct traces of copper, and, as I have said before, when referring to the Ogwen Lake water, it is extremely undesirable that a water, which is used for drinking purposes, should have any poisonous metallic contamination, no matter how slight the traces may be.

CLACTON-ON-SEA, in Essex, is a small but rapidly rising place. At the time I obtained samples, wells only were used, but some of the proprietors were making arrangements for the formation of water works. I hope to hear shortly that they are completed; for the analyses of my two well-water samples showed that a fresh supply is highly necessary. The samples I had were from shallow wells—one at an hotel, and the other at a private house. The hotel sample contained a considerable quantity of total solid matter and enough salt to give it, with the organic impurities present, a most offensive taste and smell; it was full of particles of suspended matter and the microscope showed decomposing muscular fibre and hairs. The water ranked far beyond the fair limits of a third-class water, and was totally unfit for use. The sample from the private house was on the whole better; there was little sediment and the microscopical examination gave much more satisfactory results. It is quite

clear, however, that it is unsafe to drink the water from any of the private wells at Clacton, unless it has been previously examined and ascertained to be pure.[1]

CLIFTON is a suburb of Bristol, and the same Company appears to supply both places with water from the Dundry Reservoir. At the time my sample was obtained it was said that there were frequent complaints as to the character of the water; but, of course, any statement of this kind must be judged by inquiries on the spot, as it is very difficult to find a place where some persons do not grumble. Certain it is, however, that my sample was turbid, from the presence of suspended matter, and it had a slightly objectionable smell and colour, and a very unsatisfactory microscopical appearance. Altogether it ranked second class, although nearly on the margin line between first and second.

COATHAM, in Yorkshire, has a population of some 4,000 and the chief supply is from the Stockton and Middlesborough Water Company, who obtain their water from the River Tees, about three miles above Darlington, and then filter it; the supply is constant and available for fire. My sample had traces of suspended matter, and, when warmed, a slight, although distinctly evident, smell and taste of peat; so that it is clear the River Tees must be fed to some extent with water from peaty gathering ground. The nitrogenous compounds were fairly low, but as in all peaty waters, there was a very large amount of oxygen absorbed by organic matter, and this, with the unsatisfactory physical characteristics, put the water low down in the second-class list.

COWES (EAST), in the Isle of Wight, has a population of about 2,500, and part of the town has an intermittent public supply derived from rainfall, and said to amount to the enormous quantity of fifty gallons per head per day. The water is stored in covered reservoirs, but was not efficiently filtered at the time my two samples were obtained. One of the samples had a trace of suspended matter; but both of them passed the microscopical examination satisfactorily. The water was soft and the albuminoid ammonia low, but the oxygen absorbed was larger than was desirable. Despite this defect, however, both samples were sufficiently pure to come just within the boundary line of first and second class waters.

COWES (WEST) has a population of some 6,000, and the number of visitors is in excess of this during parts of the year. This portion of the town has only an intermittent supply, which is derived from springs, and pumped through filter beds into reservoirs: I had two samples, one from a main in the town, and the other from a reservoir,

[1] Since this has been in type I have received a sample from the well of the new waterworks, which is apparently of satisfactory quality.

and the physical characteristics of both were good. The chemical results showed that there was less solid matter, far less salt and considerably less hardness than in the East Cowes samples, and the increase which appeared in the albuminoid ammonia was so trifling as to be of no moment. This water ranked as first class, and was higher up in that class than the East Cowes samples.

CROMER, in Norfolk, has a population of about 1,500, and the visitors, who come mostly from neighbouring districts, average about 1,000. When my sample was obtained, attempts were being made to obtain a public supply, and I am informed that works are nearly completed, and that by the time this is published they probably will be quite finished. They are badly wanted, for the water supply from the public and private wells is of the most wretched character. A sample from the town pump had a distinct green tint and an offensive smell, and nauseous taste of salt and nitrate of soda. It swarmed with animalculæ—no other word will express its state—while the dried residue showed crystals of urea and alkaline urates. The chemical results showed that it contained nearly fifty grains of salt per gallon, and its hardness was 54 degrees. The total amount of nitrogen combined as ammonia, albuminoid ammonia, and nitrates, was nearly six grains per gallon. This water showed the extremely high valuation of 380, or more than ten times the limit between first and second class waters. It was concentrated, but fairly oxidised sewage.

A sample from what is known as Baker's pump was a little better, but still bad; it was full of animalculæ, and had a dirty colour, offensive smell, and putrid taste. The nitrates were considerably lower, but the total valuation was 103, and it could only be classed as a grossly contaminated sample, unfit to drink. I also received a sample from a private well which had a dirty green colour and an offensive smell, with an extremely nauseous taste. The chemical results were, on the whole, better than those of the two public pumps, but taking all into account, this could not be classed otherwise than as a bad third-class water.

DARTMOUTH, in Devonshire, has a population of about 10,000. Nearly the whole of the town is furnished by the Local Authority with an intermittent supply of water. The sample I examined was peaty, which gave to the water, when warmed, the objectionable taste always found in such waters. The chemical results were, on the whole, satisfactory, but it needed filtration to free it from some suspended matter which was present, and it would be better if the peaty water were excluded from the reservoir. These defects, however, were not sufficient to prevent the water ranking as first-class.

DAWLISH, in Devonshire, has a population of about 4 or 5,000,

but has no public water supply, the inhabitants being dependent entirely upon private wells. My two samples were drawn from places at some considerable distance apart, and yet they were fairly in accord. Both samples were free from smell, but in one of them there was a slightly objectionable taste; the albuminoid ammonia was fairly low, but the nitrates were high. The water was fairly soft, but there was a very large loss on ignition; the results of the microscopical examination were very unsatisfactory, evidently showing animal contamination. The waters both ranked as third class, although they were in the best division of that class.

DEAL, in Kent, has a population of about 8,000, and is supplied with water by a company, who also supply the neighbouring parish of Walmer, which has a population of about 4,000; the water is pumped from wells into a reservoir, whence it gravitates into the town, part of which has a constant supply, and part a supply lasting for about four hours per day. The quantity furnished is evidently quite insufficient, being only about twelve gallons per head per day; the water needed filtration, for each of the three samples I received contained traces of suspended matter: it was also hard, although not harder than the majority of the chalk waters from that district. The amount of nitrates was high, but this also is characteristic of chalk wells. My three samples were very accordant in composition, and were all sufficiently good to rank in the first class, although not far from the boundary line of the second class.

DEVONPORT, in Devonshire, has a population of about 50,000, and the supply is derived from Dartmoor, and is said to be obtained from springs in the granite, and the water is stored in a service reservoir. When my samples were obtained there were no arrangements for filtration, but works for that purpose were in course of construction, and it was hoped that they would be completed by the middle of this year. Filtration is certainly desirable, for there were clear proofs from the chemical results that the water needed oxidation; part of the gathering ground is evidently peaty, as the water had the yellow tint and peaty taste which is always acquired by passing over such a ground. The microscope also showed considerable traces of vegetable contamination. There was a good deal of difference between the three samples I analysed, which were obtained at some short interval of time from each other; but I think the difference was not greater than would be accounted for by a moderate amount of rainfall taking place on peaty ground, and passing into the collecting reservoirs. Two out of the three samples were sufficiently good to rank as good specimens of a first-class water, while the third would rank as second class.

DOUGLAS, in the Isle of Man, has a population of about 14,000,

and is supplied with water by a company, who obtain it from mountain springs and rainfall, and pump about twenty gallons per head per day. The sample I had of the supply was of good quality, containing a very small quantity of solid matter, and was extremely soft, and very low in nitrogenous constituents. It was entirely free from suspended matter, and the microscopical results were quite satisfactory. The sample ranked as a good first class one.

DOVER has a population of about 30,000, but, considering the size of the town, the number of visitors is small as compared with most of the other watering places referred to. There is a constant supply, which is said to be derived from a well in the chalk on the Castle Hill. The chemical results of the analysis of my sample showed that it was a rather hard water, although greatly softened by boiling; the albuminoid ammonia was low, and the nitrogen as nitrates by no means excessive. The water was free from suspended matter, and the microscopical results were quite satisfactory. Taking all the points into account, it ranked as a very good first-class water; Brighton and one or two other places on the south-eastern coast have about equally pure supplies.

DOVERCOURT is really only a suburb of Harwich. It is partly supplied with water from an artesian well, which is supplemented by a supply from public and private wells; but as it is necessary to quote several analyses, I shall refer more fully to this place when writing of the Harwich supply (see p. 13).

EASTBOURNE, in Sussex, has a population of about 15,000. It has a constant public water supply, amounting to nearly fifteen gallons per head per day, and I am informed that that quantity is amply sufficient for flushing the drains as well. This statement is a remarkable one. The water is said to be supplied from green sand springs; but from the figures of the analysis of my samples, it is much more probable that the water really comes from the chalk strata. The physical and microscopical characteristics of these samples were perfectly satisfactory, and they were free from suspended matter. The only objectionable features in the chemical results were the hardness and the salt, and an undesirable increase in the amount of nitrogen as nitrates over that which should be present in the best first-class waters. These, however, were the only faults, and the samples came well within the boundary line of first and second class.

EXMOUTH, in Devon, has a population of about 5,000 or 6,000, and is supplied with water by a company, who give an intermittent service which is said to be cut-off entirely on one day in the week. The water is said to be drawn from springs in the gravel at Squagmoor, on Blackhill. My sample was satisfactory; it was quite free from smell, taste, or any objectionable physical characteristics; it was very soft, and the

nitrogenous compounds were low. It ranked among the very purest of the first-class waters.

FALMOUTH, in Cornwall, has a population of about 6,000. I was unable to obtain any official particulars as to the supply, but it is reported to be drawn mainly from a river and springs, and to be pumped into service reservoirs for distribution. I had two samples, both of which were said to be drawn from main taps on the same day, but at places at some distance from each other; these two samples differed very considerably, both in their chemical and physical results. Both of them were more heavily contaminated with peaty matters than any waters I have hitherto referred to; this peaty contamination gave them a yellow colour, and in one case a very offensive smell and taste. The microscopical examination of both clearly showed that a large amount of vegetable impurities were present. Chemically considered, the water was soft, and contained but little solid matter or salt; but there was a larger proportion of nitrogenous constituents than was desirable.

FELIXSTOWE, in Suffolk, is a very small place, with a population apparently of less than 1,000 inhabitants. The water is reported to be drawn from natural springs in the adjacent hills; but my sample was not so good as might be expected from such a history, and if the source is really what is stated, the springs must be contaminated; for the proportion of nitrogen as nitrates was extremely high, and the chlorine calculated as salt was also rather high. These impurities point to animal contamination of some kind on the gathering grounds from which the springs are fed. The microscopical examination showed the presence of much vegetable tissue in the residue, but there were no clear indications of animal remains. The water was very hard. In the tabulated results I have put it in the second-class list, but taking its fair valuation, it would probably have been more correct to have put it in the third-class table. It greatly needed efficient filtration.

FILEY, in Yorkshire, which has a population of between 2,000 and 3,000, has a constant supply of water furnished by a company who obtain it from springs at Hunmanby. Most of the houses are supplied by this company, but some few have private wells. The sample of the company's water which I examined contained much suspended matter, had a dirty yellow colour, and, when warmed, an offensive smell, which gave a strong suspicion of urine, and it also had an objectionable taste. The results of the microscopical examination were unsatisfactory. Although the water contained only a moderate amount of totally solid matter, the loss on ignition was very high, and the albuminoid ammonia much more than it should be. Both chemical and physical results, therefore, showed unsatisfactory features, and the valuation was such as to bring the water into the third-class list.

I analysed one sample from a private well in the town, which was *said* to be used for washing only. The microscopical examination of this sample showed numerous crystals of urea and urate of potash, while the smell and taste fairly resembled those of a sample of stagnant sewage. The proportions of nitrogen as albuminoid ammonia and as nitrates were excessive, while the proportion of oxygen absorbed was one of the heaviest which I have recently met with. Taken as a whole, this was one of the worst samples I obtained from the seaside places, and it is therefore essential that visitors to Filey should take care that they are not supplied with well water even for *washing only*, unless it is very different in character from the sample I analysed.

FOLKESTONE has a population of 13,000, and is said to be supplied with water from a number of shallow wells belonging to a company who own the Cherry Tree Waterworks; the supply is reported to be intermittent. My sample was slightly turbid, from the presence of traces of suspended matter, but otherwise it had a good colour. Owing to the hardness of the water, and the precipitation of the lime, a slight chalky taste was perceptible on warming. The microscopical results were quite satisfactory; the water would be improved by filtration, as the suspended matter would be removed. The chemical results were satisfactory, the water was hard, and the loss on ignition was higher than is desirable, but taking all the impurities into account, the water showed a valuation of only thirty-one, which is within the first-class limit.

FRESHWATER, in the Isle of Wight, has no waterworks, and my informant there stated that the drinking water was mainly obtained from the River Yar, and carried round the place in casks to supply the houses. A correspondent denies the accuracy of this statement, but I have no other reason to doubt that it is correct. Some of the inhabitants have private wells. The sample which I had of the supply from the River Yar was, as regards physical characteristics, fairly satisfactory. There was a considerable amount of vegetable matter present, but I could not detect any living animalculæ; the taste was flat, but not indicative of any previous sewage contamination; the water was rather harder than I should have expected from a river water, and albuminoid ammonia was present in sufficient proportion to give the water a valuation of forty-nine, which is about half-way between first and third class. My sample from a private well in use at Freshwater ranked as sewage rather than water, or perhaps, to be more correct, I should say impure diluted sea-water: it contained 138 grains of total solid matter per gallon, of which 110 grains, or nearly $\frac{1}{4}$ oz., was common salt, and the microscope showed a large number of particles of decomposing organic matter. Clearly, although the water from this well was stated to be used only for cooking purposes, it ought not to be so used.

GOSPORT, in Hampshire, also includes in its water supply some of its rural suburbs. The population is about 22,000, and the water is supplied by the Gosport Water Company, who obtain it from an artesian well 320 feet deep. The supply amounts to about 300,000 gallons per day, and is constant during the day time. It is said that many of the inhabitants are not supplied by the company. I had two samples of the company's water, and found both to be of a satisfactory character: they were free from suspended matter, smell, or taste, and the results of the microscopical examination were also satisfactory, while the chemical results showed that the water was moderately soft, and that the nitrogenous constituents were low. Both samples came well within the limits of first-class supplies.

GREAT CROSBY, in Lancashire, has a population of about 6,000, and is said to have a constant supply from the Liverpool Water Works. The sample I examined was fairly satisfactory; the objectionable features were that when warmed it had a slightly offensive smell, and that it contained more albuminoid ammonia than should be present in a first-class water, and the nitrogen as nitrates was also rather high. Viewing all the results, both chemical and physical, it may be considered as an upper second-class water.

HARWICH AND DOVERCOURT, in Essex, have a population of probably nearly 10,000. There is a public supply from an artesian well which is said to be 400 feet deep, but the supply is insufficient to furnish a constant service to the whole of the town, and the best houses get a supply for 18 hours a day, and the poorer houses for less. It appears, however, that the inhabitants are dissatisfied with the character even of this limited supply—and that they have good reason to be so is shown by the fact that water from some public pumps is taken round in carts, and sold at so much per gallon, or per pail, and that there are also private pumps supplying houses, or series of houses, in the town. The supply from the artesian well is excessively saline. The sample I analysed contained more than 90 grains of chloride of sodium per gallon, and was so heavily contaminated with organic matter that the loss on ignition amounted to more than ten grains per gallon; it was excessively hard, quite turbid and milky from the presence of suspended matter, and the briny taste was very objectionable. Even supposing that this water were organically pure, it would be unfit to drink, by reason of the large proportion of salt which it contained. The valuation of it amounted to 262, which was sufficient to put it beyond the limits of even the third-class public supplies.

I also analysed a sample from a public pump called the Barrack pump; the well from which this is derived is said to be 36 feet deep, and this is one of the sources from which the water sold in carts is

obtained. This water was far less saline than the town supply, containing, as it did, only 12 grains of salt per gallon. It was very hard; the albuminoid ammonia was rather high, and the nitrogen as nitrates excessively high: when warmed there was a slightly offensive smell, and a distinctly offensive taste. The examination did not disclose the presence of any animal remains, but a considerable amount of vegetable matter was present. Viewing all the results there is no doubt that the water was far superior to the town sample, although it was still so bad as to show a valuation of 114, and rank as bad third-class.

A sample from a pump which supplies a large number of houses in two of the principal terraces of the town was considerably worse than the Barrack pump sample; the solid matter had increased by nearly 50 grains; the loss on ignition was excessive, and the hardness was no less than 57 degrees. The taste of the water was soapy and alkaline, probably due in part at least to the large amount of nitrates present; the microscope did not disclose any features which were particularly unsatisfactory, but the valuation of the water amounted to 171—quite sufficient to show that it is of such a quality that its use for drinking purposes should be prohibited.

I also analysed a sample from a private well which supplied some houses in the town. The details of this analysis differed very considerably from the last reported upon, and although some were more satisfactory, others were less so, and on the whole the sample was as bad. The nitrates had increased to more than double the amount present in the last sample, and when warmed there was a distinct, though not very strong, smell of urine; the taste was objectionable, and the microscopical examination showed that the water had evidently been contaminated with drainage matter. This water also is quite unfit for drinking, and the pump should be at once closed.

HASTINGS AND ST. LEONARDS, in Sussex, have a joint population of about 30,000, but as is well known the number of visitors is large in proportion to the population. The water is derived partly from springs, and partly from rainfall, and is supplied intermittently for seven hours, or so, a day—the supply averaging about 20 gallons per head, on the population, per day. At the time I obtained my samples, the greater part of the water was filtered, and arrangements were in progress for filtering the remainder. There are two main sources of supply, viz., Buckhole Water Works, and Hollington Well, the former of which principally supplies Hastings, and the latter St. Leonards. I had altogether six samples from these places, and it is satisfactory to find that they were all sufficiently pure to pass just within the line of first-class waters, although the waters had imperfections, which ought not to be found in them, and the character of the

supply is more variable than should be the case in large towns like these. Thus, for instance, I found in the first two of my samples traces of suspended clay, which gave a slight yellowish tint to the water, and showed clearly the necessity for the improved arrangements for filtration. All of the samples were fairly soft, but the difference between them was considerable, ranging from 8·7° to 4·5°, while the total solid matter ranged from 15·2 grains to 25·7 grains per gallon. These irregularities point to the necessity not only for improved filtration, but of greater storage room, so as to render the character of the water uniform. The microscopical examination gave satisfactory results, and I think on the whole the supply of Hastings and St. Leonards must be viewed as satisfactory, notwithstanding the irregularity—bad feature though it is in any water supply.

HERNE BAY, in Kent, with a population of about 2,000, has a public supply, which I understood is constant; and there is also a public pump and, I believe, private pumps as well. The sample of the public supply which I examined was fairly satisfactory: it was of course hard, being derived from a chalk well, situated at a short distance from the town. The loss on ignition was high, but the water was noteworthy as containing less nitrogen in the form of nitrates than any other waters from the chalk wells in this district; this, of course, is a great point in its favour; the nitrogen as albuminoid ammonia was also very low, and the microscope did not disclose any unsatisfactory features. The water must be ranked as a first-class one.

There is a public pump on the parade, the water from which is far too apt to be used for drinking purposes by visitors or their children; this pump is very near to the sea, and it is quite evident, from the analysis of a sample I obtained, that a considerable infiltration of salt water takes place. It may be that this infiltration varies at different times, but of that I have no means of judging. The water contained a large amount of nitrogen as nitrates, and the nitrogen as albuminoid ammonia was heavier than it should be—that is to say, in their two worst forms the nitrogenous compounds were in excess, and the oxygen absorbed by organic matter was also high; the water contained a considerable proportion of suspended matter, which gave it a milky appearance. The total valuation of the sample was 80, which makes it a bad specimen of a third-class water.

HORNSEA, in Yorkshire, has a population of about 2,000. When I obtained a sample, public pumps and springs only were used, but arrangements were in progress for a public supply, and, by the time this is published, I hope they will be completed; the results of the analysis of a sample which I received from a public pump showed that the authorities were not making arrangements for a better supply any too

soon. The water was hard, saline, and heavily contaminated with organic matter; the nitrogen as albuminoid ammonia and nitrates was excessive, and the sample had a distinctly offensive taste. I trust this pump will be closed as soon as the public supply is completed.

HUNSTANTON, in Norfolk, is a very small place, with a population of about 1,000. The water is pumped from a well called the Chlak Well, but it is nevertheless said not to be situate in the chalk; there is a constant public supply, equal to about thirteen gallons per head per day during the visiting season. I examined two samples: the first contained a large amount of suspended matter, which was entirely absent in the second sample; in the first the albuminoid ammonia was only ·0032, while in the second it had increased to ·0069. In both cases the water was hard; the results of the microscopical examination were satisfactory and the water was free from smell or taste. It is possible that the suspended matter present in the first sample may have been derived from some accidental contamination, but the valuation was such, that the first sample ranked as a good second-class water, while the second sample was a first-class one.

HYTHE, in Kent, has a population of about 3,500, and the number of visitors is relatively small; it has a constant water supply, which is derived partly from springs and partly from wells, and amounts to about twenty gallons per head per day. The chemical and physical results of the sample I examined were fairly satisfactory. The water was rather hard and showed more loss on ignition, *i.e.* organic matter, than was desirable, but with the exception of a slightly unpleasant taste, the physical results were on the whole satisfactory. It ranked as a fairly good water just on the margin of first and second class.

ILFRACOMBE, in Devon, with a population under 4,000, is supplied with water from springs in the slate shale and has a constant service. In 1874, Mr. Wynter Blyth expressed a satisfactory opinion with reference to the water. My sample, however, differed very considerably as regards total solids, while the other details of the analysis were fairly accordant. The microscopical examination was not thoroughly satisfactory; there was a considerable amount of vegetable matter present in excess of what should be found in a water containing so little solid matter, and the albuminoid ammonia was rather above the proper proportion. Viewing all the results, the water ranked in the lower division of the first class.

KINGSWEAR, in Devon, has a population of about 2,000. The supply is intermittent, but is considered to be sufficient in quantity. It is supplied from a reservoir, which is said to be fed by springs in the slate shale. The character of the sample I analysed was generally very good; it was soft, and the nitrogenous constituents were present in fairly low proportions, while the only contamination traceable by the micro-

scope was of vegetable origin. The sample had only nine degrees of hardness, and ranked as a good first-class water.

LITTLEHAMPTON, in Sussex, has a population of some 3,000, and at the date of writing it has no water works, although arrangements are being made by the local authorities for supplying the town with water from a deep bore-well. This step is not being taken any too soon, for when my samples were obtained the inhabitants and visitors were entirely dependent on the supply from private wells; and, as is unfortunately too frequently the case, as my readers will have seen, the water from these wells proved to be of an absolutely dangerous character. I examined samples from two wells here; one contained more than 11½ grains of volatile matter per gallon, 15 grains of salt, and its hardness was 38 degrees; the albuminoid ammonia was ·0141, or nearly three times as high as it ought to be, and there was an excessive proportion of nitrates; the taste was offensive, and the microscopical results were unsatisfactory. This water is, therefore, a very bad third-class one, which I should be almost justified in calling sewage. The other sample contained 112 grains of total solid matter per gallon, 17 grains of which were volatile or organic matter driven off on ignition; it contained nearly 57 grains of salt, which was enough to give it a distinctly saline taste, and the colour of the water was a dirty yellow green; the microscope showed not only living organisms of various kinds in abundance, but pieces of skin and muscular fibre, and an excessive proportion of organic remains of all kinds. The use of such waters as these by any person who had not become gradually habituated to them would unquestionably be attended with danger.

LLANDUDNO, in Carnarvonshire, has a population of about 3,000. The water supply was recently transferred from the company who had before managed it to the Improvement Commissioners of the town. The Commissioners, however, were evidently dissatisfied with the source from which the supply was then being obtained, and they are now making arrangements to supply the town with water from Llyndulyn lake about fourteen miles distant, which will give them a better supply of pure water. It appears that the supply which was in use when my sample was drawn was obtained from springs on the Great Orme's Head. This sample showed a heavy loss on ignition, and the amount of salt was more than was desirable; the water was fairly soft, and the albuminoid ammonia was low; but when warmed, it had an offensive smell and taste of decomposing vegetable matter. The microscopical examination quite confirmed this by showing the presence of a vast amount of vegetable debris. I subsequently had two more samples sent me, and they showed that owing to some cause—most probably to attention having been called to the matter by the papers I had published

—the supply had considerably improved, and at that date might fairly be ranked as a good second-class water.

LLANFAIRFECHAN, in North Wales, is supplied partly by a water company and partly by private supply: the company's water is derived from little springs and rivulets on the hill sides; the private supply is from the river which flows down the valley in which the village is situated, but the river is tapped above the village. From the samples I examined, the two supplies appear to be almost identical in character. They were both extremely soft, and contained a very small proportion of mineral matter, while the nitrogenous compounds were lower than in most waters of that class. The only objectionable feature in the chemical results was that the amount of oxygen absorbed was rather high, showing either that the waters would be improved by more aeration, or that they contained some vegetable matter. Taken as a whole, the results in both cases were very satisfactory, and both samples ranked as first-class ones.

LOWESTOFT, in Suffolk, has a population of about 15,000, and is supplied by a company, who own the gas and water works, but who declined to give me any information with reference to the sources of the supply. The sample I obtained was of a fairly satisfactory character; the hardness was comparatively small; but the albuminoid ammonia was higher than it should be, as were also the proportions of nitrogen, as nitrates and nitrites. The oxygen absorbed was also excessive; but the physical characteristics were good, the sample being free from smell and taste, and almost free from colour. It was just possible to put it within the limit of first-class waters. If the classification had been carried to its utmost limit, the sample would have perhaps appeared as an upper second instead of a first-class water.

Some houses in the town are supplied by private pumps, and I had a sample from one which was in use at an hotel there, and the results were eminently bad; it contained nearly 60 grains of salt per gallon, while the organic matter driven off by ignition weighed more than 28 grains per gallon, and the nitrogen in all four forms, viz. as ammonia, albuminoid ammonia, nitrates, and nitrites was excessively heavy. All these points, however, fall into comparative insignificance by the side of the microscopical results, which showed that the residue left by the evaporation of a few drops of the water was full of urinary salts, and the peculiar growth of cells which takes place on the addition of sugar when water has been contaminated with drainage was especially marked. The water was the worst but two which I examined in the course of this inquiry. It is only just to repeat here what has already been published, viz. that the sample did not come from the Royal Hotel.

LYMINGTON, in Hants, with a population of about 5,000, has no public water supply. I had two samples; one of them, which was drawn from a pump at an hotel, contained 63 grains of total solid matter per gallon, of which nearly 12 grains were volatile organic matter driven off by ignition, and 16 grains were salt, and it contained also 1·33 grains of nitrogen as nitrates. The sample showed nearly 20 degrees of hardness. It had an offensive smell and taste; and, as to the microscopical results, it is enough to say that it would not be easy to find a stagnant pond which presented a greater variety of specimens of living animalculæ. This water was totally unfit for human use, and yet at Lymington it was considered a good water. The other sample was forwarded to me by a correspondent, and was obtained from a well which had recently been repaired and cleaned out: this was a better water; there were no animalculæ, and the chemical results, generally speaking, were of a satisfactory character. At the date this sample was drawn the water which the well was yielding was apparently a good and safe one; but as the other sanitary arrangements of the town appear from the information I received to be so imperfect, that drainage or dust holes and other receptacles for refuse are likely to contaminate the wells, it is clear that it would not be safe for visitors to assume the water at any house in Lymington to be pure, until it has been analysed and favourably reported on.

LYNTON, in Devon, is supplied with water by a company who obtain it from a river the water of which is said to be naturally filtered through sand. The general character of the water, to judge by my sample, is very satisfactory; the oxygen absorbed was rather higher than was desirable, but there were very small quantities of vegetable matter, and the mineral constituents and hardness were extremely low. The water may be ranked as a first-class one.

LYTHAM, in Lancashire, is supplied by the Fylde Waterworks Company, which also supplies Blackpool—(see *ante*, p. 3). My sample from the mains at Lytham was almost identical with those which were drawn at Blackpool. The worst feature was the excessive amount of oxygen absorbed; but this, no doubt, was due to the contamination with peaty matter which had obviously taken place. It must be borne in mind, in reference to Lytham as well as Blackpool, that at the date the samples were drawn the company were labouring under difficulties owing to the leaking of a reservoir.

MARGATE, in Kent, has a population of 15,000, and, considering the extent to which it is frequented, even if it cannot be called a fashionable watering-place—its population being perhaps trebled during the visiting season—it is badly off for water. The supply is derived from two wells in the chalk, the old one being in a bad position com-

paratively near the town, and only about 50 feet deep; while the new one, recently sunk in a better position, and at a greater distance from the town, has, unfortunately, turned out to be either too small or not deep enough to furnish anything like the quantity of water required. There is a constant supply, but the quantity furnished appears to be insufficient. I examined two samples—one from a drinking fountain, and one forwarded to me by the company from the old well. The chemical results of the analyses of the two samples were somewhat similar, and were nearly equally unsatisfactory. There had evidently been no attempt at filtration; the samples agreed in being excessively hard and saline, indicating apparently that infiltration from the sea was taking place, while the amount of nitrogen as nitrates, was in excess of what it should be. The microscopical appearances showed the presence of a great deal of vegetable matter. A comparison of these results with those of other analyses which I made twelve months previously, appear to show that the water is of an extremely variable character. It must be ranked as one of the worst, if not the worst, of the second-class supplies, and it would perhaps be more just to place it as third class.

MARSKE-BY-THE-SEA is one of the small places in Lancashire which is partly supplied by the Cleveland Water Company, and partly by private wells. My sample of the company's supply was very satisfactory in character; the mineral matters were low, and the nitrogenous compounds were as low as could fairly be expected, while the microscope did not disclose any unsatisfactory features. Altogether the sample ranked as one of the best of the first-class waters.

I also examined a sample from a well near the church; this water was rather saline and hard, and the proportion of nitrogen as albuminoid ammonia and as nitrates was larger than in the Company's supply. All the physical and microscopical results were satisfactory, but still, as a whole, the sample cannot rank higher than fair second-class water. There is a spring in Windy Hill Lane, the water from which was until recently used by a large number of the inhabitants for drinking purposes. A sample of this water proved not to be so good as the last one referred to; it contained much more mineral matter, and the proportion of volatile organic matter was also considerably higher; the common salt amounted to more than 26 grains per gallon, which was sufficient to give it a saline taste. It is hardly right to class this water as absolutely dangerous; but still it is a bad specimen of a third-class water, and should be avoided if possible.

MARYPORT, in Cumberland, has a population of about 7,000, and has a constant supply which is derived from a river and pumped into a reservoir after being filtered through sand and gravel: the palpable defect in this water is that the filtration, as shown by the sample which I received,

is inefficient. The sample had a slight yellow colour due to the presence of suspended earthy particles; and this, notwithstanding that the dissolved mineral matter was low, and that the water was extremely soft. It contained a proportion of nitrogen as albuminoid ammonia, to which no particular exception could be taken except that it was rather high in proportion to the other figures of the analysis. It was evident from the microscopical examination that there was some peaty contamination in the gathering grounds of the river which may account for the high proportion of oxygen absorbed, and for a slight, but perceptible, taste which the water had. On the whole it may be passed as a fair second-class supply.

MORECAMBE, in Lancashire, has a population of about 4,000; it has a constant supply of water derived from springs, amounting to from 20 to 25 gallons per head per day. The water is not filtered.—**POULTON**, which is a suburb of Morecambe, is supplied by the same company. I had two samples, one from each place, and they showed closely concordant results. The water was extremely soft, and contained a very small proportion of mineral constituents; it was almost as low in this respect as the Loch Katrine water. The nitrogenous constituents were as low as could fairly be expected, and the microscopical examination was satisfactory. The only fault in the water was that there was a slight amount of suspended matter owing to the neglect of filtration; but, even allowing for this, the two samples were of excellent quality, and ranked among the best of the first-class supplies.

NEW BRIGHTON, also in Lancashire, has an intermittent supply derived from a deep well. My sample of the water was soft, but contained more mineral constituents, and also a larger proportion of nitrogen in the form of nitrates, than the waters I have lately referred to. The microscopical examination was quite satisfactory, and, on the whole, the water must be classed as a good specimen of a first-class water.

NEWHAVEN, in Sussex, will probably be viewed rather more as a port of departure for the Continent, than as a watering-place pure and simple. The Railway Hotel and a few of the houses situated on that side of the harbour are supplied with water pumped by the railway company. My sample was of a tolerably satisfactory character; as regards organic impurities it was fairly low, the only objectionable feature being that the nitrogen as nitrates amounted to nearly ·3920 of a grain per gallon. The microscopical examination showed traces of vegetable matter only. It was a good second-class sample.

Some other parts of Newhaven are supplied with water drawn from Mr. Hobbs's well; and my samples of this water were not so good as that from the railway company's property; there was more vegetable

contamination than in the other sample, but no animalculæ, and no distinct traces of any animal contamination. From the figures of the analysis I should think it is a chalk well, and possibly, or rather probably, contaminated by sea water. The two samples from this well ranked as third class, but they were good specimens of their class.

Some of the houses in the town have private wells, and I received a sample from what was supposed to be one of the worst. If it is so, it cannot be considered as relatively bad compared with many other wells similarly situated; it was well within the limits of third-class water, and although a third-class water is most undesirable to drink without filtration, yet this sample seems to show that filtration would probably very greatly improve it. It is true the sample was very hard, and contained a large amount of mineral matter; but the albuminoid ammonia was low, and so was the oxygen absorbed, and if efficiently filtered the water would very probably pass as second class.

PAIGNTON, in Devonshire, has a population of about 4,000; it has a public supply, but many of the inhabitants prefer the water they obtain from private wells. The public supply, which is furnished by a company, is said to be derived from springs in limestone hills to the south of the town. The sample which I examined contained 20 grains of mineral matter per gallon; it was moderately hard, fairly free from nitrogenous compounds, and from smell and taste; while the microscopical examination gave very satisfactory results. On the whole the water ranked as a good first-class one.

I also had a sample from a private well which was said to be used by visitors and residents at an hotel; the results of the analysis of this sample showed a much larger amount of mineral matter, salt, and lime salts, while the proportion of combined nitrogenous matters was increased sixfold. When the water was examined by the microscope it resembled the water of a stagnant ditch in its appearance; it was full of bacteria and other forms of animal life, and contained many fragments of decomposing animal matter. It was a third-class sample. If this may be taken—and I think it may be—as a specimen of the private well supply of Paignton, it is not safe to trust to the character of the wells until the water has been analysed.

PENMAENMAWR, on the North Wales coast, has a population of about 2,000; there is a constant supply of water derived from springs and rivers in the mountains, which is filtered before it enters the reservoir. The chemical results of the sample which I analysed were very satisfactory; the amounts of mineral constituents, and of organic and nitrogenous constituents, were among the lowest of those given by any sample referred to in this pamphlet, and the physical and microscopical properties of the water, with the exception of a very

slight peaty smell, were satisfactory. The water was one of the best of the first-class supplies.

PENSARN, in Wales, has a constant supply which is derived from the same source as the Abergele supply (see *ante*, p. 1). My sample was in many of its features satisfactory; but there was evident indication of peaty contamination which gave an offensive colour, taste and smell to the water. There is no doubt that this sample was more highly contaminated than the Abergele sample, but the difference may be due to a dirty main which I am informed exists between the two places. This sample ranked as second class.

PENZANCE, in Cornwall, has a population of 10,000 or 12,000, and has a constant water supply, derived from springs and rainfall, amounting to about 30 gallons per head per day, but which, unfortunately, is not filtered. There are two reservoirs, and I analysed a sample from each, and also a sample from a main in the town. The sample from what is called the Larger Reservoir was drawn from a pipe in the mayor's house. The results of the analysis showed that the most unsatisfactory features were that the amount of oxygen absorbed by organic matter was high, the water had an objectionable greenish yellow colour, and the microscope disclosed the presence of a large amount of vegetable matter.

The sample from the Old Town Reservoir showed rather more total solids and salt; the variations in the other figures in the analyses were scarcely worthy of mention. This water had a decidedly better colour; but, as regards microscopical appearance, it was as nearly as possible identical with the last sample.

The third sample was obtained from a druggist's shop, and most probably consisted of a mixture of the water from the two reservoirs. It showed, however, a larger amount of organic matter driven off by ignition, and, from some cause or other, the nitrogen present as albuminoid ammonia had considerably increased. Putting all these three analyses side by side, the Penzance water must rank among the low first-class waters.

PLYMOUTH, in Devon, has a population of some 80,000. I have received complaints as to the turbid character of the supply at times, although the total solids and nitrogenous constituents in my samples were extremely low. The complaints received some verification from the fact that a sample drawn, in the centre of the town, on October 9, 1877, contained a heavy quantity of suspended matter. I had two samples—one from a drinking fountain, and one from an inn close to the public offices. The chemical results of the two samples were very closely concordant, and showed that the water was soft, very free from volatile organic matter, and low in nitrogenous constituents, the most objection-

able feature in the chemical results being the high proportion of oxygen absorbed. The microscope showed the presence of a great number of minute particles of disintegrated vegetable tissue, which I have no doubt were derived from a peaty gathering ground, and the smell and taste of the water when warmed quite confirmed this view. Considering all the facts, however, I could not rank the water as other than first class.

PORTISHEAD, in Somersetshire, has a population of between 2,000 and 3,000. It is supplied by a company who are said to pump the water from limestone wells to a reservoir. The results of the analysis of my sample were generally satisfactory; organically the water was of very great purity, and beyond the objectionable hardness—which, however, is not excessive—it is impossible to find fault with the chemical results. The sample was quite free from suspended matter, and the microscopical appearance was satisfactory, and altogether it ranked as a good first-class water.

PORTMADOC, in North Wales, has a population of about 4,000. There is a constant water supply derived from a lake at a distance of some seven miles from the town. The water is not filtered. I had two samples, and in both cases the chemical results were satisfactory, with the exception of a slightly high proportion of albuminoid ammonia, and a very high proportion of oxygen absorbed. Both these defects were doubtless due to the presence of a large amount of confervoid growths which had taken place in the water. If this were prevented the supply would certainly be of first-class quality. As it was, it ranked among the better portion of the second class.

PORTSMOUTH, in Hampshire, with a population of about 125,000, has but comparatively few visitors. It has a partly intermittent and partly constant supply, furnished by a company who obtain their water from springs at the outcrop of the chalk. The water is not filtered. The samples I examined were drawn at some weeks' interval; the chemical results in both cases were quite satisfactory, and the differences between the two samples were not more than was fairly to be expected from the interval of time which elapsed between their being drawn. One sample contained traces of suspended matter, but the microscopical and physical results of both were satisfactory. Taken as a whole, these samples ranked as first-class ones.

POULTON, in Lancashire, is supplied from the same mains as Morecambe, of which it is a suburb, the supply to which has already been referred to (see *ante* p. 21).

PWLLHELI, in South Wales, has at present no public supply. Most of the inhabitants derive their water from public wells or pumps, of which there appear to be only about half a dozen in the town. Some of the inhabitants under these circumstances naturally use, or perhaps are

obliged to use, rain water, either filtered or unfiltered. I received a sample of (so-called) unfiltered rain water from some refreshment rooms in the town, and its general characteristics agreed with those of rain water which had been subjected to some slight contamination during its collection, but had not been stored in tanks sufficiently long to let animalculæ grow in it. It was sufficiently pure to rank as a fair first-class water. I also examined a sample from one of the public pumps, and this was certainly one of the most satisfactory of the *public pump* waters I have reported upon. The water was soft, contained little mineral matter, was fairly free from nitrogenous and organic constituents, and the only characteristics to which objection could fairly be taken were that it had a flat and slightly peaty smell and taste. Notwithstanding this, it could not be considered as other than a low first-class water.

RAMSEY, in the Isle of Man, has a population of about 4,000. The water, which is obtained from mountain springs and rainfall, but is not filtered, is supplied under constant pressure to all parts of the town, except during the summer time, when, of course, the place is full of visitors, and then it is shut off occasionally during the night. This is another of those waters which contained an extremely small amount of total solid matter, and was very free from nitrogenous organic constituents, except as regards the albuminoid ammonia, which was unsatisfactorily high; but it is evident from the comparatively large amount of oxygen absorbed, and from the smell, taste, and microscopical appearance, that it had been contaminated by being obtained from peaty gathering grounds, and the water could only rank as a second-class one.

RAMSGATE, in Kent, has a winter population of about 16,000, and, during the season, this increases to 45,000 or 50,000; the Local Board have recently purchased the water works, and intend to give a constant supply. The water is derived from a well which is sunk in the chalk at a distance of some three-quarters of a mile from the town. I examined two samples, which agreed very closely in the chemical and physical results. The water was hard, as of course might be expected, coming as it did from a chalk well; and the amount of nitrogen in the form of nitrates was more than was desirable, although the nitrogen, as albuminoid ammonia, was moderately low. The physical characteristics of both samples were perfectly satisfactory, and the results of the microscopical examination showed that the water was entirely free from any animal contamination. Both samples ranked as first-class ones.

REDCAR, in Yorkshire, has a population of about 2,500. The water supply, which is derived from springs in the sandstone, is in the hands of the Local Board, who furnish a constant service from a small storage reservoir, containing about one day's consumption. The results of the

sample I examined were on the whole satisfactory; the water was soft, and moderately free from nitrogenous and oxidisable organic impurities. The physical results were also satisfactory, and the microscope showed that the sample was free from animal contamination. It ranked as a first-class water.

RHYL, in Wales, with a population of about 5,000, is supplied by the Llanivydd Company, which also supplies Abergele. The chemical results of the analysis of my sample were very accordant with those obtained from the Abergele water, while there was no great difference in the physical and microscopical results. The only objectionable feature in the water was a considerable amount of contamination with vegetable matter; the gathering grounds are said to include some peat and plough land, which may be the cause of this contamination. At the time my sample was drawn, the water was allowed to run through old mains, which had previously been used to convey an inferior supply before the present one was adopted, and these mains were said to be heavily coated with the impurities deposited from the previous water. The filtering beds they have in use seem to be insufficient or out of order.

ROTTINGDEAN, in Sussex, is a small village a few miles east of Brighton; it has no public supply, but some public wells and a few private ones. The water from the private wells, is, however, found to be so saline, that most of the drinking water is obtained from a public well said to be 200 feet deep, and probably sunk into the chalk. I examined two samples from this well, and, as might be expected, the water was hard; it contained a large proportion of nitrates, which was not irreconcilable with the fact of the water coming entirely from the chalk, but it was also very saline, both samples containing between 24 and 25 grains of salt per gallon. The worst features were that the water had an unquestionable smell and taste of sulphuretted hydrogen and excreta, and that the microscopical examination disclosed the presence of minute hairs, and of fragments of cotton fibre. These impurities must have been due to some surface drainage passing into the well, or to some other accidental cause. The Medical Officer of Health sought to explain the impurities which I found, by alleging that plumbers had just been at work in the well. Water in the condition in which my samples from this well were, cannot be considered as better than bad third class.

There is another well near the police station, which was said to be used at times, although whether for drinking or cooking, or both, I cannot say. My sample from this well contained 401 grains of total solid matter per gallon, of which 323 grains were salt; the nitrogen as nitrates, was 1·6 grains. The water had a milky green colour and an offensive smell;

the taste of course was briny—three-quarters of an ounce of salt per gallon would hardly fail to make it so. The microscopical examination showed many animal remains entangled in the crystals of salt—proving, at any rate, that the contamination was not entirely due to infiltration of sea water. Viewing all the results, the valuation amounted to 914, showing this water to be the worst out of nearly 350 samples of seaside water which I examined and reported upon.

RYDE, in the Isle of Wight, with a population of about 12,000, has an intermittent supply, furnished by springs at Knighton and at the base of the Ashey Downs; the water is collected and pumped into reservoirs, from which the town is supplied. The results of the analysis of my sample were very satisfactory. The water was very free from organic constituents; it was rather hard, but entirely free from suspended matter, and the colour, smell, and taste, were all good. The microscopical results did not disclose any unsatisfactory feature. It was a good water, ranking among the upper first-class supplies.

ST. ANNE'S-BY-THE-SEA, on the Lancashire coast, is a small, but rapidly growing, place. The water is said to be supplied by the Fylde Waterworks Company, who also supply Blackpool and Lytham. My sample from this place was taken some weeks later than the Blackpool and Lytham samples. The water obtained from St. Anne's was better than that from the other two places, perhaps owing to the company having to some extent overcome their difficulties during the interval. It ranked as a good second-class water.

ST. IVES, in Cornwall, has a population of about 7,000. There appear to be two different reservoirs for the public supply, one called the Terrace Tank, and the other the Back Tallant Tank; and there is also another public supply known as the Fountain, obtained from a spring in the rock and conveyed to many houses in the town. I had a sample from the Terrace Tank, which was good; it was soft, and contained but a small proportion of combined nitrogen, while all the physical and microscopical results were quite satisfactory. It ranked as a good first-class water.

I had also a sample from the Fountain. It was very similar in character to that from the Terrace Tank; the differences between the samples were so slight that it is scarcely necessary to point them out. This sample also ranked as a good first-class water.

ST. LEONARDS, in Sussex, has already been referred to when speaking of Hastings, for which see p. 14.

SALTBURN, in Yorkshire, is supplied by the Cleveland Water Company, who also supply part of Marske-by-the-Sea. A sample from Saltburn contained a small proportion of total solids: the combined nitrogen in all forms was low and the only objectionable physical cha-

racteristic was the colour. The water, as I stated when speaking of the Marske supply, is a first-class one.

SANDGATE, in Kent, has a population of barely 2,000. The supply is partly derived from the Cherry Tree Waterworks, which supply Folkestone. The analysis of my sample showed that it contained more total solid matter than the Folkestone sample, but there was a considerable decrease in the proportion of albuminoid ammonia. These variations may have been due to the samples having been drawn at different times ; but, independently of this, the water was a good one.

SANDOWN, in the Isle of Wight, has a population of between 2,000 and 3,000, and a rather large proportion of visitors. The Isle of Wight Waterworks Company furnish a constant supply, obtained from a stream which is fed by springs at Knighton and Wroxall. I had two samples—one from a house, and another drawn several days afterwards from a tap at the waterworks—and they showed considerable differences. In the sample from the house the albuminoid ammonia was high and the oxygen absorbed very high ; both samples had a bad greenish yellow colour, and both when heated had an offensive smell and taste. There was no suspended matter, but the microscopical results were very unsatisfactory. The waterworks sample contained many bacteria. The supply was not at that time so good as it should be in such a rising place as Sandown is. It could not be ranked as better than second class.

SANDWICH, in Kent, is a small town with only a few thousand inhabitants. It has no public water supply, but there are several pumps, most of which apparently derive their water from what is known as the Delf Stream, which runs through the town ; and there is also one called the Market Pump, which is not supplied from the Delf Stream. A sample from this pump contained more than 29 grains of salt per gallon and 103 grains of total solid matter, the albuminoid ammonia was more than five times as high as it should be, and the nitrogen as nitrates, was excessive. The microscope showed that the residue left on evaporating a few drops was full of decomposing animal remains and muscular fibre. This water was polluted to such an extent that its use would be attended with danger. A sample from a pump drawing from the Delf Stream, was better by far ; but still the albuminoid ammonia was rather high, and there was an objectionable astringent taste, while the smell resembled that of water in which leaves had been decaying. It is possible that this taste and smell may have been caused by a tan yard, which is said to be situated on the banks of the stream. The water was full of living organisms, and therefore, despite the more satisfactory chemical results, could only be looked upon as a bad third-class one.

SCARBOROUGH, in Yorkshire, has a population of about 27,000.

It has a constant supply of water, which is obtained from springs, and amounts to about 26 gallons per head per day. I analysed two samples drawn on different dates. The water was somewhat hard, and contained rather more nitrogen as nitrates, than was desirable, but the albuminoid ammonia was low. The samples had a very satisfactory colour, and were quite free from offensive smell; the microscopical examination gave satisfactory results; and the only objectionable feature was, that one sample had a very slight astringent taste which resembled alum. Whether this taste had been acquired from the alum shale, which abounds in the neighbourhood, or not, I cannot say; but, notwithstanding this, the water ranked as a first-class one.

SEAFORD, in Sussex, has a population of about 1,500. There is no public supply, but there are a large number of wells. I examined three samples from three different wells: one from a druggist's shop contained more than 100 grains of solid matter per gallon, of which 44 grains were salt; it showed a hardness of 29 degrees, and nearly 2 grains of nitrogen as nitrates. The water swarmed with living animalculæ, and contained decomposing animal remains. It is to be hoped that this water is not used for dispensing purposes, as my sample was so bad that the well should have been closed immediately my analysis was published.

Another sample which I examined was from a well at an hotel which is supposed to be supplied with good water; this contained less solid matter than the last sample, but the salt amounted to 37 grains per gallon, and there was 1·3 grains of nitrogen as nitrates. The smell was most offensive, the taste was quite saline, and the water was full of living organisms. This water, also, was unfit to drink.

The third sample was obtained from a well which supplied some ten houses; the solid matter was higher still, and the salt reached the high figure of 76 grains per gallon; the water had an unmistakable taste and smell of fæces, and its briny character rendered it probable that it had a good percentage of urinary salts as well. This water, therefore, must be emphatically condemned as sewage.

SEATON, in Devonshire, is a very small place of only a few hundred inhabitants, many of whom are supplied by water from springs in the chalk hills, said to be some three miles inland; while the remainder are dependent on private wells. I had a sample of the public supply, which, generally speaking, was of a fairly satisfactory character; the water was hard, although not so hard as many of the chalk waters are; the albuminoid ammonia was low; there was no suspended matter, and the colour, smell, and taste were satisfactory; but the objectionable feature was that the microscope showed a few living organisms, and this was just sufficient to carry the water from first into second class.

I also had two samples from private wells. One had 17 degrees of hardness, and contained 17 grains of common salt; the albuminoid ammonia was on the margin line between first and second class, and the nitrates were heavy. This could not be considered as better than a third-class water. The other sample showed a slight increase in the salt and the hardness; a great increase in the albuminoid ammonia and nitrates; while the volatile matter amounted to 15 grains per gallon, and the microscopieal results were extremely unsatisfactory. This is a very bad third-class water, unfit to drink.

SHANKLIN, in the Isle of Wight, has a population of about 3,000, and has a partial public supply from springs in the hills at the back of the town. The results of the chemical analysis of my sample were quite satisfactory, the albuminoid ammonia being extremely low; there was, in fact, only one important defect in it, and that was that the microscope showed it to be full of bacteria and other allied species. Therefore here we have another instance of a water derived from what ought to be an almost absolutely unpolluted source being ranked lower than first class, merely through neglect of filtration and proper precautions in storage.

SHEERNESS, in Kent, has a population of about 14,000, and is supplied by a well said to be 380 feet deep; but the site for it, which is near to the sea, has been very badly chosen, and much trouble is caused by blowers of sand. When my sample was obtained the local authorities were sinking a new well into the chalk, which will probably be completed shortly after this is published. At the time my sample was obtained the supply was intermittent, but it was stated that, as soon as the new well was completed, the authorities intended to give a constant service. The water was not filtered, and was consequently turbid; it was free from smell and taste, and the microscopical results were quite satisfactory. The chemical results were almost uniformly good, the albuminoid ammonia being as low as in any sample I have previously referred to. It was a first-class water.

SHOREHAM, in Sussex, a few miles west of Brighton, has a population of about 4,000. The water is derived from springs in the Southdown chalk hills, and there is a eonstant supply, in which the Kingston and Southwick districts are included. I examined two samples which were drawn from the mains at an interval of about a fortnight; the chemical results of both samples were satisfactory, excepting that the proportion of albuminoid ammonia was rather higher than desirable. The physical eharacteristics of one sample were perfectly satisfactory; but the other had a considerable quantity of suspended matter consisting apparently of iron, which had probably been derived from the pipes, and gave a tint to the water. This, I

think, must have been due to some accidental circumstance; but, independently of that, the water was a good first-class one.

SIDMOUTH, in Devon, has a population of about 4,000 or 5,000. A large proportion of the water which is used is collected from springs in the sandstone hills, but there are private wells in addition. The analysis of a sample of water from the springs gave fairly satisfactory chemical results; the only thing to which any exception could be taken being the loss on ignition, which was rather high. The only objectionable characteristic of the water was that the microscope showed some bacteria. If it had not been for this, the water would have ranked as first class.

SOUTHEND, in Essex, with a population of about 3,000, is supplied by an Artesian well at the back of the town; the well is said to be 900 feet deep, and there is a constant supply. My sample showed that the water contained a rather large proportion of solid matter, viz. 68 grains to the gallon, of which 38 grains were salt. This would seem to indicate that the bore tube must have been leaking, for it is extremely uncommon to find water drawn from such a depth as 900 feet so saline as this. The water was singularly soft, the hardness being only 1·6 degrees; the albuminoid ammonia was moderate, while the nitrogen as nitrates, was high. The water was free from smell, but the salt was quite sufficient to impair the taste. It ranked as a second-class water.

SOUTHPORT, in Lancashire, has a population of nearly 20,000, and is supplied from the same mains as its suburb Birkdale, which has already been fully referred to (see p. 3). I examined a sample from Southport, and the results were nearly identical with those of the Birkdale sample, and showed that the water was a good first-class one.

TEIGNMOUTH, in Devon, has a population of some 7,000. The waterworks are in the hands of the Local Board, who furnish a constant supply during the winter, but only an intermittent one during the summer time when the town is full of visitors, and more water, of course, is being used. This is not as it should be. The supply is derived from the green and red sandstone, and amounts to 25 gallons per head per day; but there appear to be at least three different sources, which differ considerably. I had two samples drawn with an interval of about a fortnight between them; the chemical results of both were of a satisfactory character, there being no single feature which could be more strongly objected to than the oxygen absorbed, which was ·0380 grains per gallon. The colour, smell, and taste were satisfactory; the microscopical appearance of one sample was good, but the other contained a few bacteria. On the whole, however, the

quantity was not sufficient to condemn the water, which must be ranked as first class.

TENBY, in Pembrokeshire, has a population of about 4,000, and is supplied by two reservoirs known as the Old and New Reservoirs; there is a constant supply, but it is not filtered. A sample from the Old Reservoir gave very satisfactory chemical results; the objectionable features were that there was some suspended matter, showing the necessity for filtration, and the colour was yellow. Notwithstanding these drawbacks, however, this water must be considered as first class. A sample from the New Reservoir differed very greatly in chemical results from the last referred to; the albuminoid ammonia was six times as heavy, and the oxygen absorbed had increased threefold; there was a distinct peaty taste and smell, and the microscope showed that it was full of bacteria. Taking all the results into account, it ranked as a bad second-class water. I also had a sample from the mains in the town, which probably consisted of a mixture of the water from the two reservoirs, and to a great extent the chemical results upheld this view; but the oxygen absorbed had still further increased to an excessive extent, and the microscope showed a few bacteria and diatoms. This sample was a second-class water.

TORQUAY, in Devon, has a population of about 25,000, and has a public supply which is the property of and under the control of the Local Board. At the time my sample was obtained, the supply was intermittent, and was said to be derived from granite springs. It was extremely soft, the hardness being less than one and a half degrees, and it contained less than six grains of solid matter per gallon; there were slight traces of suspended matter consisting of vegetable fibre, and there was little doubt that the slight smell which the water had might be traced to the same source. It ranked as a good first-class water.

VENTNOR, in the Isle of Wight, has a population of about 6,000, and during the winter season it probably has a larger proportion of visitors than any other watering-place except Hastings and Brighton. It is supplied by a company with water said to be obtained from large springs which were tapped in cutting the railway tunnel through the hill behind the town. The supply is constant to the greater portion of the town, but that part which stands at a high level above the sea has only an intermittent supply; the water is not filtered. From the figures of the analysis of my sample it would appear that the water is most likely derived from chalk strata; the hardness before boiling was 17 degrees, and after boiling 3 degrees. The nitrogenous constituents were low, and there was no particularly unsatisfactory feature in the chemical results. The physical and microscopical results were also satisfactory. It was a good first-class water.

WALTON-ON-THE-NAZE, in Essex, has a resident population of some thousand or so. It is supplied by a Company with water which is said to be derived from an Artesian well 400 feet deep, but at the time my sample was obtained strict orders had been given at the works not to allow any one to have a sample from there, so of course I obtained one in the town, and the results of the analysis were of such a character that it is not surprising the Company should wish to prevent its publication. The sample contained nearly 183 grains of common salt per gallon, and therefore would be better described as diluted brine than as water; the other results present no features which need special attention, because it was practically impossible for anyone to continuously drink a liquid containing such an amount of salt. If the well really is an Artesian one, it is evident that the bore tube leaked at that time. It was said that the authorities were applying for leave to borrow £7,000, in order to obtain a better supply, and it is to be hoped that they have carried out their intention or will do so very quickly.

There were also two or three pumps in the town, the water from which was used for drinking purposes. This water used to be taken round in carts and sold by the pail or gallon. A sample from one of these pumps—Turpin's Farm pump—contained nearly 13 grs. per gallon of volatile organic matter and more than 19 grs. of salt; the hardness was 22 degrees, and the albuminoid ammonia was high enough to rank it as second class, without taking any other determination into account, while the proportion of nitrogen as nitrates was also heavy. The microscope showed that it contained numerous living organisms. It had an offensive smell and taste, the latter so marked that there was no doubt that the water had had recent urinary contamination. The water from this pump was clearly unfit to drink, and its use should be prevented.

A sample from a pump called Walford's Farm pump, was somewhat better. The volatile organic matter only amounted to eight grains per gallon, and the salt to thirteen grains; but on the other hand the albuminoid ammonia had considerably increased and amounted to ·0107 grains per gallon. This sample had an unpleasant smell and taste, although not so bad as in the previous sample, and altogether it could only rank as bad third class.

WATERLOO, near Liverpool, is only a small place, and has an intermittent supply derived from springs. The sample I analysed was moderately soft, and it was fairly low in nitrogenous constituents; there was, however, a good deal of suspended matter, consisting mainly of chalk and clay, which rendered the water slightly milky. The microscopical examination did not reveal the presence of any impurities

beyond the traces of amorphous suspended matter already referred to; the smell was satisfactory, but there was a slight objectionable taste. The water ranked as a good second class one.

WELLS, in Norfolk, with a population of between 3,000 and 4,000, has no public supply, but a number of private wells, the water being obtained in most cases by means of pumps, one of which frequently supplies several houses; the wells are all rather shallow, some of them being only six feet deep. I had samples from two pumps, one of which was supplying three or four houses; the volatile organic matter in this water amounted to nearly fourteen grains per gallon, the salt to eighteen grains; the hardness was 36 degrees, the albuminoid ammonia ·0082 grains, and the nitrates 2·61 grains. The water had a yellowish green colour, and contained a large quantity of suspended matter, and the microscope showed organic contamination. As the result of all these impurities the valuation of the water amounted to 154, showing that it was a dangerous water for drinking purposes.

The other sample was from a pump which was supplying an hotel; it was free from suspended matter and had a fairly satisfactory colour; the total solid matter—salt, albuminoid ammonia, and nitrates were each of them little more than half those which the last sample contained. The microscopical appearances were also much more satisfactory; the water ranked as a third class one, with a valuation of 72. It is eminently unsatisfactory that a town with a population of above 3,000 should be dependent for its water supply upon shallow wells of such a character as these.

WESTGATE, in Kent, about three miles from Margate, is supplied from a well in the chalk, which is sunk on the top of a slight hill at the back of the place; it is supplied under constant pressure. The sample I examined was hard, but the amount of salt was comparatively small, and the nitrogenous constituents, especially the albuminoid ammonia, were very low, and the physical and microscopical results were quite satisfactory. The water was a good first class one.

WESTON-SUPER-MARE, in Somersetshire, has a population of some 2,000, and a large relative number of visitors. It was supplied by a Company, but when my sample was obtained the works were being transferred to the Local Board; the water is said to be obtained from limestone springs, about one mile and a half from the town, and is collected in reservoirs, which supply nearly the whole of the town, some twenty or more houses having an independent supply. My sample contained a rather large amount of solid matter, viz., 56 grains per gallon, and nearly 25 grains of salt; the albuminoid ammonia was very low, but the nitrogen as nitrates amounted to ·5180 grains per gallon. The proportion of salt was sufficient to give it a distinctly saline taste,

and it had a perceptible smell of decaying vegetable tissue. The quantity of vegetable matter present was very great. If the water had been efficiently filtered, so as to free it from this impurity, it would probably have passed as first class; as it was, it ranked as second.

WEYMOUTH, in Dorsetshire, has a population of about 14,000, and is supplied from a spring rising from the greensand, about three miles and a half from the town. The water is not filtered, but is supplied under constant pressure from a reservoir which is 200 feet above the town. I had two samples, both of which were of a very satisfactory quality; the water is harder (thirteen degrees) than is usual with greensand waters, but with the exception of a rather large proportion of nitrogen, in the form of nitrites, present in one sample, the results were quite satisfactory. The water was a first class one.

WHITBY, in Yorkshire, has a population of between 12,000 and 13,000, who are furnished with a constant water supply derived from deep springs. The water is said to be naturally filtered through a fine grain silicious sandstone. A few inhabitants are still supplied by independent wells. My sample of the public supply contained only a small quantity of total solid matter, and the nitrogenous constituents were very low; the oxygen absorbed was particularly high, but that was the most unsatisfactory feature; traces of chalk were deposited after standing some time, and there was a clearly perceptible smell and taste of peat. But for this peaty contamination, the water would certainly have been a good one; as it was, however, it passed just into the second class.

I had one sample from a private well which was still in use in the town, and this was eminently unsatisfactory in its character. The loss, on ignition, amounted to 18 grains per gallon, and the sample had a brown colour and an offensive smell and taste, and contained nearly 15 grains per gallon of suspended matter; the albuminoid ammonia was ·0600, or more than ten times as high as it should be in a good water. It is scarcely necessary to do more than glance at these figures in order to see that concentrated sewage is the only phrase which correctly describes the character of this water.

WHITEHAVEN, in Cumberland, has a population of about 19,000, who have a constant supply of water derived from a lake; there is a filtering bed in the service reservoir, which, however, only holds one day's supply. My sample of the water was very soft, the hardness being less than one degree, and it contained only five grains of total solid matter per gallon; there was a trace of suspended matter, consisting of clay and earthy *débris*, proving that the service reservoir was too small and the filtration inefficient. This was a great pity, because, were it not for this, the Whitehaven water would have been the purest

of those which I examined for this Inquiry; as it was, however, it stood very high among the first-class waters.

WORTHING, in Sussex, some ten miles west of Brighton, has a population of about 10,000. It is supplied from wells 400 feet deep, but when my sample was obtained the supply was only intermittent. The water appears to be derived from chalk strata, as it had a hardness of 16 degrees, which was reduced to three degrees on boiling: the albuminoid ammonia was very low. The physical and microscopical results were quite satisfactory. The water was a good first-class one.

YARMOUTH, in Norfolk, has a population of more than 40,000; it is partly supplied with water by a Company, but a considerable number of the older houses are still supplied with well or pump water, which some of the inhabitants seem to prefer. A sample of the Company's water was by no means a good one, the loss on ignition amounted to no less than 12 grains per gallon, and the albuminoid ammonia was ·0166, or at least three times as high as it should be. The water contained traces of suspended matter, which gave it a dirty yellow colour, and the microscope disclosed the presence of fragments of hairs and cellular tissue; the water was said to be filtered, but if so, the filtration was quite inefficient. The valuation was 78, bringing it into the third class.

A pump known as the Dene Well pump was said to be used by the inhabitants, and a sample of this water contained 112 grains of total solid matter per gallon, of which nearly 19 grains were volatile organic matter, driven off on ignition, and 41 grains were salt; the hardness before boiling was 34 degrees, the albuminoid ammonia was ·0119 grains per gallon, or more than twice as high as it should be, and the nitrogen as nitrates amounted to 4·1978 grains per gallon. The water was of a pale urine-yellow colour, and had an offensive smell and taste; the microscope showed the presence of crystals of urate of ammonia and urate of soda, together with well defined pieces of animal tissue. The valuation was 314. The use of such a liquid as this in the place of drinking-water is absolutely dangerous.

I also had a sample from the Church pump, the water from which is also largely used by the inhabitants; this sample contained less solid matter than the last water referred to, but the volatile organic matter was nearly as high, as was also the albuminoid ammonia; the salt was reduced to about 16 grains per gallon, but the oxygen absorbed had considerably increased. The water had a most offensive smell and taste, and contained traces of suspended matter; it was full of animal fibre, and contained, also, living organisms. It is impossible to do anything but condemn this water as decidedly as the Dene Well water, for although the valuation of the impurities was not so great, yet in

this case also it is sufficiently high to indicate that the use of the water is dangerous.

YARMOUTH, in the Isle of Wight, has no public supply, and the inhabitants obtain their water from wells, many of which serve several houses each. I had one sample as a specimen of the character of these wells, and it was very unsatisfactory; it contained nearly 20 grains of salt per gallon, and nearly 6 grains of volatile organic matter; the nitrogen as nitrates amounting to 1·6 grains per gallon. The microscope showed many particles of animal remains, giving the strongest evidence of organic contamination; the valuation of the water was 119, bringing it clearly within the dangerous class of waters.

SUMMARY.

It has naturally been a matter of difficulty in an extensive series of analyses such as these have been to classify the samples fairly; indeed, without the adoption of a numerical scale of valuation, such as I have already proposed, it would have been impossible, but by adopting the only plan which gives a due value to every determination made in the course of the analysis, instead of taking only one or two of those determinations into account, sorting into groups in order of merit becomes comparatively easy. The question which is then of most importance to ordinary readers and to consumers of water is as to the basis of the classification, that is, at what point of the valuation the line of demarcation between first and second and between second and third-class waters has to be drawn. If I were to attempt to define the limit I have adopted by quoting a large number of examples, it would only tend to confuse, but I will give two illustrations which I think will show in a clear manner where I draw the line between first and second class. The supply to South London by the Southwark and Vauxhall Water Company is generally such that, if valued according to my valuation scale, it will show a value of about 34. I have chosen 35 as the limit of first-class waters. The Southwark and Vauxhall supply is therefore just within the limit of the first class, while the water of the Kent Water Company, which supplies another portion of South London, will show, according to the same scale, a valuation of about 22, and it ranks therefore as a good first-class water. This latter water, it must be remembered, is the one which is generally taken by Dr. Frankland in his reports as the standard to calculate the amount of *organic* impurity in the other waters from. There were, however, many waters, the analyses of which are referred to in this pamphlet, such, for instance, as those of Beaumaris, Brighton, Kingswear, Llanfairfechan, Paignton,

Penmaenmawr, and Whitehaven, which showed a considerably lower valuation, and, therefore, a considerably greater degree of purity than the Kent Company's water, this greater purity being no doubt largely accounted for by the absence of the objectionable permanent hardness which is characteristic of the Kent Company's supply. Any sample which I place in the second-class list is worse than the Southwark and Vauxhall supply—that is, in general terms, we may say that it is worse than the worst of the London supplies. I am certainly not one of those who look upon the London supplies as being so utterly bad as they are represented to be by some persons. I think filtration is imperfectly carried out as to some of them, and that in some cases sufficient care is not taken to avoid pumping when the river is in a turbid state; but in drawing the limit of first and second class I am not taking these theoretical considerations into account, but only the supply as it at present exists.

I cannot give any equally well-known illustration to define the margin line between second and third-class waters, but, in a general sense, it may be taken that an average third-class water is at least three times as heavily contaminated as the average supply of the Southwark and Vauxhall Water Company, while many of the wells and two or three of the public supplies in my third-class table were really so impure as to be incapable of classification under any other name than diluted sewage or sewage.

One illustration of this may be pointed out. I draw the line between first and second-class waters, as I have said, at 35; between second and third at 55; and between third and worse at 75. There is, however, one place I have reported on, viz. Walton-on-the-Naze, where the valuation of the public supply runs up to 488, and another still worse case, viz., the sample from the well near the police station at Rottingdean, the valuation of which amounts to 914.

From these remarks it will be seen that the scale of classification I have adopted is a lenient one, inasmuch as any supply better than or as bad as the much-abused London supply passes as first-class.

I shall be quite prepared after this to find that some of my readers should wish to subdivide the first class themselves, so as to form what they deem a really first class; if so, they have simply to apply the numerical scale already published in the 'Sanitary Record' and the 'Analyst' to the figures in the tabulated reports, and judge from the total valuation obtained. Thus, for instance, it will be found that the valuations of Whitehaven, Kingswear, Llanfairfechan, and Marske-by-the-Sea, are each under 15, while those of Ventnor, Teignmouth, Brighton, Dover, and New Brighton, are each under 20. Now, taking into account the amount of impurity which must be found in even the purest natural

water, it is quite safe to say that in every one of these cases, if the impurities derived from accidental or *preventable* contamination were doubled, the waters would still be well within the limits of first-class waters, while all of them are purer than the Kent Water Company's supply to London. These and a few others, therefore, form the upper division of the first class.

On the other hand, taking the maximum of the valuation scale, I am of opinion that in most cases, unless special circumstances which may be brought to light modify the view of the particular case in question, a value of 100 should be looked upon as absolutely prohibitory, and as a proof that the water is utterly unfit for any domestic use.

I pass now to an epitome of the results obtained in this Inquiry, viewed from what I may call a national rather than a local point of view. Out of the 107 places reported upon, 53 have a first-class supply, 34 have a second-class supply, and 5 have a third-class supply, while 15 places are supplied by wells of which unfortunately many (I may say most) are bad, and out of the 107 places 16 have wells in addition to the public supply, and in some of these cases also the wells are very bad.

At the first glance there is a point of great interest evident in the relation between the residential population and the visiting population, of the places supplied with pure water and those supplied with water of a less degree of purity. The population of the 53 places which are included in the first-class table is somewhere about 450,000, and the number of visitors during the whole season may be estimated at 1,300,000—that is, the visitors are in the proportion of about 290 to every 100 of the residential population.

The population of the 34 places which are comprised in the second-class table is 260,000, and I estimate the total number of visitors at 360,000; that is, where the water is less pure than it is in the former places, the proportion of visitors is 135 to every 100 of population.

The population of the five places which rank as third class is 60,000, but the number of visitors has fallen still lower in proportion, being estimated at about 40,000, or 67 to every 100 of population.

With regard to the towns supplied by wells only, the population is estimated at 40,000, and the visitors at 40,000 also. It would not, however, be wise to attempt to subdivide these wells into classes, because the number of places which have first and second-class well supplies is so small that it would be dangerous to draw any inference from them except that, viewing the question in a general light, well water may usually be considered unfit to drink until it has been analysed and found pure. Therefore, leaving out of the question those towns which are supplied by wells alone, and considering only those which have public water supplies, we have a clear

indication of the fact that the public choice of a seaside health resort is not quite so capricious as it is generally thought to be, and that by some species of intuition, the public do judge which are the best and most healthy places to visit. In those towns where the water is of the best quality, the visitors number nearly three times the population, in those where it is second class the visitors are nearly one-third more in number than the residents, while in those towns where the water is third class the visitors amount only to about two-thirds of the population. This is a striking and perhaps inexplicable feature of these reports, and if the deduction was drawn from only a few leading cases or only from places in one district, there might be some objection to accept it as a general fact, but the figures are taken from the whole of the places on the sea coast of England and Wales, and the results show that people go where they can get the best water. Their choice is not dependent upon the size of the place, for the first-class towns have an average population of about 8,700, the second class of about 7,600, and the third class of about 12,000. Neither does it seem to be dependent on geographical position, for as far as can fairly be judged the proportion of visitors is moderately concordant all round the coast: nor does it appear to depend upon whether the watering-place is an old-fashioned one or one which has recently come into repute, for there are some cases in each of these categories where the water is of the best class and also of the worst class.

The question, therefore, arises whether the paucity of visitors in some of the towns is the cause of the neglect of the sanitary authorities in providing a proper water-supply or the effect of that neglect. I am quite aware that it may be said that in a town frequented by few visitors the inhabitants are not wealthy enough to be able to afford the necessary expense of furnishing themselves with a supply of pure water even though it is almost the first requisite of life. Granting that this may be the case, the advice which should be given to the public is clear —there is no reason why people should go away to seek health and court illness instead. When the local authorities of these places have enterprise enough to furnish a pure water-supply, then let visitors flock there; but until that is done, even the few visitors who now go to places where the water-supply is so impure should go elsewhere.

I incline, however, to the opinion that the neglect of the sanitary authorities is in most instances the cause rather than the effect of the paucity of visitors; in fact, there are some few cases to which I might point where the local authorities would be much better called unsanitary authorities, because, held back by their parsimony or by the pressure of the municipal electors, at whose bidding they choose to act, they practise economy where economy is folly, and by that means

prevent their town attracting the visitors, who would ultimately furnish the money required to repay that which had been spent in making the necessary sanitary improvements. This latter view gains great additional weight when we find that such places as Bognor, Cromer, Dawlish, Harwich, Littlehampton, Lymington, Rottingdean, Yarmouth in Norfolk, and Yarmouth in the Isle of Wight, are supplied wholly or partly by wells almost every one of which ranks as third class, and a large proportion of which would be better described as sewage. Out of the 107 places reported upon, 92 have a public supply, and in 16 cases the public supply is supplemented by private or public wells. Among these are Bognor, Beaumaris, Herne Bay, Lowestoft, Paignton, Abergele, Bridlington, Seaton, Whitby, Harwich, Aldeburgh, Marske-by-the-Sea, Walton-on-the-Naze, and Yarmouth in Norfolk. My advice to anyone intending to visit either of these places is that before going he should first ascertain whether the house chosen has a well or a public supply, and in what table it is classed; while, if it is supplied by a well, a sample should be analysed, or that town avoided altogether.

Fifteen places appear to have a private well supply only, and the population of all of them and the number of visitors is small; but it must be borne in mind that the samples I obtained from these towns, and which may fairly be assumed to be representative samples, are generally so bad that only three, viz. Alum Bay, Lymington, and Pwllheli, rank as first class; Freshwater ranks as second class; while all the rest are third class, some of them being among the very worst waters I ever examined. Visitors who go to these latter places must do so now with a knowledge of the risk they incur.

About one-half the public supplies I have reported upon are constant, and intending visitors therefore must not overlook the great advantages to be derived from that fact. Taken as a whole, the supplies of the northern and Welsh coasts are the most pure, but there is very little to choose between the south-eastern and south-western coasts if one or two notorious exceptions are left out of consideration.

It would, of course, be quite unnecessary to recapitulate here the whole of the towns where the supply is good, but I think it desirable to briefly refer now to those places where the supply is bad, and point out to the authorities that, if they have any wish either to retain the visitors who at present favour them, and from whom they make their profit, or to induce other people to select their towns during coming summers, they must make better sanitary arrangements as far as water is concerned. In the southern and south-eastern districts—Aldeburgh, Bognor, Cromer, Harwich, Lowestoft, Newhaven, Rottingdean, Sandwich, Seaford, Walton-on-the-Naze, Wells, and Yarmouth—are all supplied partly or entirely by public or private wells, and every sample from

these wells which I analysed was a heavily contaminated one. Clacton is about being supplied with better water by a deep-bore well now being sunk. It is also reported that at Littlehampton they are sinking a well.

In the northern and Welsh districts, Abergele, Filey, Hornsea, Marske-by-the-Sea, and Whitby, are all partially or entirely supplied by wells, the best of which is a third-class water; and in the south-west district and Isle of Wight, Dawlish, Freshwater, Yarmouth, Kingskerswell, Lymington, and Paignton, are all similarly supplied, and each of these waters is bad.

Here, then, we have a list of places where it is clearly the duty of the authorities where there are public supplies to close all polluted wells at once, and where the wells are polluted but there is no public supply to make arrangements immediately for obtaining one. If they will not incur the cost and trouble necessarily involved in such a step as this, then visitors who go there must do so with the responsibility resting on their own shoulders for any consequences which may ensue from the use of polluted water. It needs but a glance at the tables to see how great the contamination is in some of these wells; many of them reach a degree of impurity according to the valuation scale exceeding 200, while in two or three cases it is over 400, and the highest, as before mentioned, is over 900. As a whole, this well series shows that the supervision exercised by local authorities over private wells is insufficient. I am quite aware that there are great difficulties in the way of their dealing efficiently with the matter; the proprietors of the wells are in many cases poor, and in some instances the wells have no proprietors at all, but are used by the inhabitants of a number of houses, but still it seems to me that, whatever the difficulties in dealing with the subject may be, it is the duty of the authorities to take such steps as will enable them to do so in an efficient manner.

As to the public supplies, it is satisfactory to note that there were but seven of my samples which ranked as third class or worse, and in two of these cases the impurities appear to have been to some extent accidental or temporary, so that, as I have before said, five places only really have third-class supplies. There are three public supplies, however—namely, Aldeburgh, Harwich, and Walton-on-the-Naze—which are not fit for drinking purposes. The analysis in each case would seem to indicate that the contamination was mainly due to the infiltration of salt water; but however this may be, the valuation of the Aldeburgh water is 268, that of the Harwich and Dovercourt water 262, and that of the Walton-on-the-Naze water 488, the latter being the worst of all the public samples I analysed. The amounts of salt which they contained were respectively 89, 92, and 183 grains per gallon, so that it can hardly be wondered at that all had a saline or briny taste.

I think I have now referred as fully as is necessary to the leading characteristics of each of the three tables, and to the principal deductions to be drawn from them.

It was not to be expected that such an inquiry as this could be commenced and completed without some ill-feeling being raised. No body of men like public condemnation, and yet in some cases it has been part of my duty to point out in unmistakable language serious errors of commission or omission on the part of public bodies, and of course, this has been sometimes resented; but the consciousness of the good done by calling public attention to sanitary deficiencies, and by warning those who sought renewed health against the risk of incurring disease, has more than compensated for this resentment.

I trust that those local authorities who have been warned will not ignore the warning, but will in every case (as I am pleased to find they have in some cases) take all the necessary steps to avoid condemnation in future, and I also hope that those towns which have been satisfactorily reported on will still maintain their high character.

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SERIES A.—Public Supplies of First Quality.

Explanation.—The letters immediately following the name of each place indicate the source from which, and the person by or through whom, the sample was obtained M. means Main-Tap ; R., Reservoir ; F., Fountain ; W., that the sample was obtained by myself or one of my assistants ; S., that it came from the Surveyor, Engineer, or other local official ; P., that it was privately forwarded by a resident or other person taking an interest in the subject. The results in the Microscope and Remarks column are summarised as shortly as possible ; Susp. means Suspended Matter ; Pb., Lead ; Cu., Copper; Fe., Iron, when it exceeds mere traces.

Name of Place		Total Solids	Volatile Organic Matter	Chloride of Sodium	Hardness before Boiling	Hardness after Boiling	Nitrogen as free Ammonia	Nitrogen as Albd. Ammonia	Nitrogen as Nitrates	Nitrogen as Nitrites	Total Combined Nitrogen	Oxygen Absorbed	Colour	Smell	Taste	Microscope and General Remarks
Bangor †	M. W.	3'30	1'30	1'05	0'9°	0'9°	0'0026	0'0045	0'0400	traces	0'0471	0'1220	Urine yell.	Good	Good	Satisfactory
Barmouth	M. W.	5'20	1'20	2'11	1'1°	1'1°	0'0022	0'0028	0'0280	,,	0'0330	0'0400	Pale blue	None	None	Unsatisfactory. Fe.
Beaumaris †	M. W.	15'60	3'63	2'80	6'5°	5'2°	0'0135	0'0036	0'0530	,,	0'0701	traces	,,	Satisfactory	Satisfactory	Satisfactory
Birkdale	M. W.	20'90	5'04	2'71	8'0°	6'5°	0'0021	0'0030	0'0840	,,	0'0891	0'0200	,,	None	None	,,
,,	M. S.	20'80	1'54	3'63	12'3°	3'5°	0'0023	0'0028	0'1120	traces	0'1171	trace	,,	Satisfactory	Satisfactory	,,
Brinham	M. S.	25'41	6'50	3'69	10'6°	4'7°	0'0056	0'0039	0'1070	0'0050	0'1215	0'0540	,,	None	None	,,
Carnarvon	M. S.	3'40	0'20	1'70	1'1°	1'1°	0'0020	0'0039	0'0280	trace	0'0339	0'0460	Pale yellow	Flat rain	Flat rain	,, Susp.
Cowes, East	M. W.	22'00	5'18	6'79	7'8°	7'3°	0'0020	0'0027	0'1220	0'0040	0'1307	0'0540	Yellow	Good	Good	,, Cu.
,,	S.	20'60	4'58	7'14	8'0°	7'5°	0'0048	0'0025	0'0980	traces	0'1053	0'0420	Pale yellow	,,	,,	,, Susp.
Cowes, West	M. W.	15'86	4'26	3'86	3'8°	3'4°	0'0032	0'0048	0'0940	0'0040	0'1060	0'0620	Pale blue	,,	,,	,, Susp.
,,	R. S.	13'66	4'46	4'45	4'2°	4'2°	0'0019	0'0025	0'2660	traces	0'2704	0'0180	,,	,,	,,	,,
Dartmouth	M. W.	12'90	3'16	2'69	5'2°	4'2°	0'0012	0'0017	0'1400	,,	0'1429	0'0220	,,	Peaty	Peaty	,,
Devonport	M. W.	2'80	0'35	1'52	0'9°	0'9°	0'0017	0'0064	0'0390	0'0030	0'0501	0'0400	Yellow tint	None	,,	Disintegrated vegetable tissues
,,	S.	4'00	1'50	1'52	0'9°	0'9°	0'0045	0'0041	0'0250	0'0230	0'0366	0'0860	,,	,,	,,	Peaty contamination
,,	P.	4'10	1'40	1'41	1'1°	1'1°	0'0026	0'0048	0'0140	trace	0'0214	0'1880	,,	,,	,,	,, ,,
Deal	S.	25'40	4'70	3'51	14'7°	4'2°	0'0015	0'0029	0'5350	0'0080	0'5474	0'0144	Yellowish	Good	Chalky	Satisfactory. Susp.
,,	M. W.	26'60	1'18	3.35	15'0°	4'0°	0'0037	0'0026	0'3740	0'0040	0'3843	0'0080	Good	Offensive	Objectnble	,,
,,	R. W.	27'40	2'87	3'51	15'1°	4'0°	0'0049	0'0023	0'3460	0'0040	0'3572	0'0200	Pale blue	,,	,,	Susp.
Douglas	S.	5'90	2'20	2'69	12'0°	1'2°	0'0033	0'0033	0'0800	0'0049	0'0906	0'0760	,,	Good	,,	Trace of rootlets and vegetable fibres
Dover	M. W.	22'90	3'08	2'81	15'0°	3'0°	0'0018	0'0024	0'1390	0'0010	0'1442	0'0110	,,	,,	,,	Satisfactory
Eastbourne	M. W.	28'40	5'02	6'38	15'1°	4'0°	0'0028	0'0023	0'5380	0'0040	0'5471	0'0130	,,	,,	,,	,,
,,	S.	30'90	5'10	7'96	16'2°	4'6°	0'0038	0'0028	0'3820	0'0060	0'3946	0'0110	,,	,,	,,	,,
Exmouth	M. W.	8'80	2'40	3'51	2'7°	2'7°	0'0022	0'0021	0'1820	traces	0'1863	0'0260	Good	,,	,,	,,
Falmouth *	M. W.	9'90	4'20	3'04	1'5°	1'5°	0'0028	0'0066	0'0240	0'0040	0'0374	0'0940	Pale yellow	,,	,,	Much vegetable contamination
Folkestone	M. W.	24'40	5'34	4'21	13'1°	4'0°	0'0023	0'0050	0'0390	0 0030	0'0493	0'0176	Good	,,	Chalky	Satisfactory. Susp.
Gosport	S.	26'20	2'94	7'20	10'5°	3'1°	0'0011	0'0019	0'0380	0'0040	0'0450	0'0360	Pale blue	,,	Good	,,
,,	M. W.	28'00	3'42	6'87	8'3°	2'9°	0'0030	0'0015	0'0280	trace	0'0325	0'0320	,,	,,	,,	,,
Hastings	M. W.	16'30	2'93	6'85	5'2°	3'0°	0'0025	0'0056	0'0560	0'0050	0'0691	0'0580	Yellow	,,	,,	,,
,,	S.	25'70	7'70	8'42	8'7°	6'2°	0'0021	0'0032	0'2490	0'0030	0'2573	0'0700	Pale blue	,,	,,	,, Susp.
,,	M. S.	26'25	6'78	8'31	8'5°	4'7°	0'0014	0'0025	0'3450	0'0050	0'3539	0'0040	,,	,,	,,	,, Susp.
Herne Bay †	S.	35'70	4'40	7'84	16'5°	6'0°	0'0037	0'0012	traces	0'0200	0'0219	0'0256	,,	,,	,,	,, Susp.
Hunstanton *	M. P.	26'50	2'03	3'51	16'0°	9'7°	0'0053	0'0069	0'6300	traces	0'6422	traces	,,	,,	Astringent	Showed imperfect filtration. Susp.
Hythe	P.	35'40	8'55	4'80	17'7°	4'4°	0'0009	0'0030	0'2340	0'0040	0'2419	,,	,,	,,	Unpleasant	Satisfactory
Ilfracombe	M. W.	8'90	2'78	2'46	4'5°	4'0°	0'0031	0'0065	0'0240	0'0040	0'0376	0'0440	Yell. green	Tart or acid	Tart or acid	Satisfactory
Kingswear	M. W.	17'40	1'04	2'93	8'8°	3'2°	0'0020	0'0030	0'1540	traces	0'1590	traces	Good	None	None	Unsatisfactory. Fe.
Llandfairfechan	S.	4'60	0'90	1'29	1'4°	1'4°	0'0012	0'0028	0'0240	0'0040	0'0320	0'0780	Yellowish	Good	Good	Vegetable contamination
,,	S.	4'40	1'40	1'41	1'5°	1'5°	0'0015	0'0028	0'0280	traces	0'0523	0'0400	,,	,,	,,	Satisfactory
Lowestoft †	M. W.	20'30	5'83	6'08	9'6°	6'5°	0'0021	0'0099	0'3302	0'0094	0'3516	0'0600	,,	None	None	,, ,,
Lynton	P.	4'80	1'60	1'64	1'1°	1'1°	0'0034	0'0055	0'0090	0'0050	0'0229	0'0560	,,	,,	,,	,, Pb.
Morecombe	M. W.	3'00	1'30	1'17	1'5°	1'5°	0'0019	0'0027	0'0280	none	0'0326	0'0780	Pale blue	,,	,,	Susp. Minute vegetable matter
Marske-by-the-Sea	P.	11'41	0'52	2'34	4'4°	3'2°	0'0028	0'0052	0'0430	traces	0'0510	0'0180	Yell. green	Satisfactory	Satisfactory	Satisfactory. Susp.
New Brighton	M. W.	14'70	2'60	5'38	4'8°	4'8°	0'0013	0'0014	0'2060	trace	0'2087	0'0120	Pale blue	,,	,,	,,
Paignton †	M. W.	20'00	0'75	2'57	12'4°	3'2°	0'0021	0'0038	0'0700	,,	0'0759	0'0220	,,	Good	Good	,,
Penmarnmawr	M. W.	3'80	0'90	1'46	1'2°	1'2°	0'0030	0'0027	0'0420	,,	0'0477	0'0480	,,	None	None	,,
Penzance	M. W.	9'60	1'00	4'68	1'9°	1'9°	0'0045	0'0043	0'0182	,,	0'1008	0'0560	,,	Satisfactory	Satisfactory	,,
,,	R. W.	11'80	0'61	5'50	1'8°	1'6°	0'0032	0'0024	0'3780	,,	0'3836	0'0620	Green yell.	None	None	,,
,,	M. W.	10'20	3'40	4'57	1'7°	1'7°	0'0066	0'0062	0'1820	,,	0'1948	0'0520	Yellow	,,	,,	Vegetable matter
Plymouth	F. W.	2'80	0'40	1'52	0'5°	0'5°	0'0031	0'0017	0'0120	,,	0'0173	0'0720	,,	,,	,,	,,
,,	M. W.	2'76	0'34	1'41	0'5°	0'5°	0'0011	0'0022	0'0140	,,	0'0168	0'0300	,,	,,	,,	,,
Portishead	P.	24'20	0'53	0'59	13'9°	4'2°	0'0068	0'0030	0'0530	0'0030	0'0656	0'0140	Good	S. peaty	S. peaty	Peaty contamination
Portsmouth	S.	20'00	1'90	2'22	13'2°	3'0°	0'0037	0'0025	0'2310	trace	0'2372	0'0180	,,	,,	,,	,,
,,	M. W.	22'00	0'18	2'11	14'2°	2'8°	0'0007	0'0012	0'0760	,,	0'0760	0'0360	Satisfactory	Satisfactory	Satisfactory	Vegetable matter
Poulton	M. W.	3'00	1'40	1'29	1'5°	1'5°	0'0024	0'0025	0'0280	none	0'0329	0'0780	Good blue	Good	Good	Satisfactory. Susp.
Ramsgate	S.	33'60	4'43	6'67	18'6°	4'2°	0'0040	0'0037	0'4880	0'0060	0'5017	0'0110	Pale blue	,,	,,	,,
,,	F. W.	28'50	4'20	6'76	19'0°	3'5°	0'0011	0'0035	0'4190	0'0130	0'4366	0'0210	Yell. green	Satisfactory	Satisfactory	,, Susp.
Redcar	P.	15'00	4'21	5'38	4.4°	4'2°	0'0074	0'0059	0'1220	0'0030	0'1383	traces	Pale blue	Good	Good	S. traces veg. fibre
Ryde	M. W.	25'60	0'25	3'51	13'2°	2'4°	0'0025	0'0030	0'0700	traces	0'0755	traces	,,	,,	,,	Trace of leaf fibre
St. Ives	R. W.	12'80	2'38	4'80	4'7°	4'2°	0'0023	0'0050	0'2240	,,	0'2313	0'0480	,,	,,	,,	Vegetable fibre
,,	F. W.	13'70	3'30	5'03	4'5°	4'5°	0'0025	0'0042	0'1930	0'0030	0'2027	0'0480	,,	,,	,,	Satisfactory
St. Leonards	M. W.	18'10	3'79	4'47	5'0°	3'4°	0'0026	0'0032	0'0380	0'0040	0'0478	0'0250	Good	None	Unpleasant	,,
,,	S.	15'20	6'29	4'45	4'5°	3'8°	0'0047	0'0037	0'0660	0'0040	0'0784	0'0340	Dirty yell.	Good	Good	,,
,,	M. S.	15'75	6'03	5'01	4'5°	3'9°	0'0022	0'0023	0'0510	0'0050	0'0615	0'0040	,,	,,	,,	,, Susp.
Saltburn ‡	M. P.	10'54	0'60	1'99	4'5°	3'5°	0'0033	0'0051	0'0460	0'0040	0'0584	0'0800	Pale blue	,,	,,	,,
Sandgate	M. W.	34'60	4'37	6'20	17'8°	4'5°	0'0022	0'0023	0'0510	0'0050	0'0615	0'0040	Urine yell.	Satisfactory	Very flat	Satisfactory. Susp.
Scarborough	M. W.	25'20	4'08	3 98	13'4°	5'4°	0'0020	0'0023	0'1090	0'0030	0'1165	0'0112	Pale blue	Fair	Fair	,,
Sheerness	M. W.	44'60	4'80	7'13	10'6°	0'2°	0'0020	0'0009	0'8320	0'0170	0'8519	0'0304	,,	Urinary Satisfactory	Satisfactory Astringent alum	Vegetable fibre
,,	S.	44'40	3'21	7'14	9'3°	2'5°	0'0024	0'0024	—	0'0058	—	0'0144	Milky brwn	Good	None	,, ,,
Shoreham	M. W.	18'30	3'09	3'63	12'6°	2'8°	0'0033	0'0044	0'0800	0'0040	0'0917	0'0160	Brown	,,	,,	,, Susp.
,,	S.	20'10	3'68	3'51	12'3°	2'7°	0'0030	0'0030	0'0560	0'0030	0'0670	0'0160	Good	,,	,,	,, ,,
Southport	M. W.	19'50	5'06	2'93	7'5°	6'5°	0'0013	0'0023	0'0420	none	0'0456	0'0500	S. iron tint	None	Good	,, ,,
Teignmouth	M. W.	20'90	1'39	3'39	9'6°	1'4°	0'0036	0'0031	0'1080	0'0040	0'1187	0'0380	Pale blue	Good	None	,, Fe. Susp.
,,	S.	22'60	1'85	3'74	11'5°	2'6°	0'0046	0'0047	0'1220	0'0040	0'1353	0'0320	,,	,,	Very good	,,
Tenby *	R. S.	15'20	2'42	3'74	5'2°	4'8°	0'0036	0'0027	0'0560	trace	0'0623	0'0160	,,	,,	Good	Good
Ventnor	M. W.	29'20	1'68	3'86	17'3°	3'4°	0'0037	0'0023	0'0980	traces	0'1040	0'0080	D. u. yell.	Satisfactory	Satisfactory	Few bacteria
Westgate	M. W.	33'50	3'50	6'78	20'0°	4'8°	0'0050	0'0012	0'7890	0'0200	0'8107	0'0288	Pale blue	Good	Good	Few traces of rootlets, Susp.
Weymouth	M. W.	23'72	1'47	3'28	13'1°	3'8°	0'0012	0'0024	0'2660	0'0140	0'2836	traces	,,	Offensive	Offensive	Satisfactory
,,	S.	20'90	1'31	3'04	12'5°	3'2°	0'0066	0'0041	0'2740	0'0060	0'2907	0'0030	Satisfactory	Satisfactory	Satisfactory	,, Pb.
Whitehaven	M. W.	5'00	0'95	0'94	0'8°	0'7°	0'0030	0'0020	0'0240	0'0043	0'0333	0'0300	Pale blue	,,	,,	,,
Worthing	M. W.	26'90	1'59	5'03	16'8°	3'2°	0'0020	0'0018	0'4060	0'0010	0'4108	0'0100	,,	,,	Flat rain	,,
														Good	Good	M. peaty contamination. Susp. Satisfactory

With respect to those marked * I have analysed another sample, which will be found in the Second-Class Table.
Those places marked † have also a well-supply, for which see Table of Results of Analyses of Samples from Wells.
With respect to the place marked ‡ I have analysed another sample, which will be found in the Third-Class Table.

SERIES B.—Public Supplies of Second-Class Quality.

Explanation.—The letters immediately following the name of each place indicate the source from which, and the person by or through whom, the sample was obtained. M. means Main-Tap; R., Reservoir; F., Fountain; W., that the sample was obtained by myself or one of my assistants; S., that it came from the Surveyor, Engineer, or other local official; P., that it was privately forwarded by a resident or other person taking an interest in the subject. The results in the Microscope and Remarks column are summarised as shortly as possible; Susp. means Suspended Matter; Pb., Lead; Cu., Copper; Fe., Iron, when it exceeds mere traces.

Name of Place Public Supply	Total Solids	Volatile Organic Matter	Chloride of Sodium	Hardness before Boiling	Hardness after Boiling	Nitrogen as free Ammonia	Nitrogen as Albd. Ammonia	Nitrogen as Nitrates	Nitrogen as Nitrites	Total Combined Nitrogen	Oxygen Absorbed	Colour	Smell	Taste	Microscope and General Remarks
Abergele† . . M. W.	8·60	1·02	1·99	4·6°	3·5°	0·0035	0·0045	0·0700	trace	0·0780	0·0860	Dirty brown yellow	Unpleasant	None	Satisfactory. Susp.
Aberystwith . M. W.	10·60	3·80	2·45	3·0°	3·0°	0·0050	0·0061	0·0250	0·0030	0·0391	0·1520	Dirty green yellow	None	,,	Amorphous sedimentary m. Susp.
,, . . P.	11·90	2·87	2·29	2·8°	2·5°	0·0042	0·0019	0·0530	0·0030	0·0621	0·1100	Pale blue	,,	Decayed leaves	Satisfactory
Barrow. . . M. W.	11·40	2·29	1·64	2·2°	1·5°	0·0037	0·0039	0·0250	0·0030	0·0356	0·0880	Vell. green	,,	None	Monads and other animalculæ. Susp.
Blackpool . . M. W.	5·60	1·40	1·29	1·3°	1·3°	0·0020	0·0048	0·0490	0·0070	0·0628	0·2780	I. whiskey	Peaty	Peaty	Bacteria and vibrions. Fe. Susp.
,, . . M. W.	6·40	2·20	1·29	1·8°	1·8°	0·0023	0·0053	0·0350	0·0070	0·0496	0·2260	Urine yell.	,,	Peaty and saline	,, ,,
Bridlington† . M. W.	21·60	0·68	3·16	12·6°	3·0°	0·0053	0·0024	0·1400	trace	0·1477	0·1040	Milky blue	—	—	Satisfactory. Susp.
Brightlingsea . M. W.	33·60	15·79	7·49	8·5°	7·8°	0·0012	0·0035	1·7930	0·0100	1·8077	0·0144	Pale blue	Fair	Slight	,, Fe.
Broadstairs. . M. W.	65·46	3·00	13·10	17·0°	6·5°	0·0012	0·0031	1·2980	0·0170	1·3193	0·0260	,,	None	Saline	Unsatisfactory
Clifton . . M. W.	17·00	1·18	1·29	11·2°	3·2°	0·0047	0·0078	0·0420	traces	0·0545	0·0440	Yellowish	Good	Objectble.	,, Susp.
Coatham . . M. P.	7·80	2·37	0·94	4·4°	4·1°	0·0067	0·0057	0·0450	0·0050	0·0624	0·1720	Pale yell.	Unpleasant	Unpleasant	Vegetable matter. Susp.
Falmouth* . . M. W.	7·70	3·20	3·28	1·6°	1·6°	0·0028	0·0052	0·0390	0·0030	0·0500	0·0980	Dark urine yellow	Most offensive	Most offensive	,,
Felixstow . . M. W.	59·10	10·88	13·34	30·0°	12·0°	0·0009	0·0023	1·9260	0·0050	1·9342	0·0032	Pale blue	None	None	,, Fe. Susp.
Gt. Crosby . . P.	27·00	5·48	4·21	8·6°	7·2°	0·0026	0·0055	0·2480	0·0040	0·2601	0·0080	Good	Offensive	Good	Satisfactory
Hunstanton* . M. W.	25·30	6·92	3·69	16·0°	9·0°	0·0038	0·0032	—	0·0086	—	0·0280	Dirty opq. yellow	None	None	,, Pb. ,, Fe. Susp.
Llandudno‡ . S.	23·40	1·92	5·04	10·2°	8·2°	0·0019	0·0023	0·1220	0·0030	0·1292	0·0140	Red yell.	Flat	Satisfactory	Vegetable matter. Susp.
,, . . R. S.	22·60	3·38	5·27	11·0°	10·5°	0·0024	0·0028	0·1370	0·0030	0·1452	0·0160	Pale g. blue	,,	,,	Woody matter
Lytham. . . M. W.	5·40	1·00	1·40	1·7°	1·7°	0·0030	0·0054	0·0250	traces	0·0334	0·2100	Dirty yell.	Unpleasant	Unpleasant	Peaty contamination. Fe.
Margate . . F. W.	64·20	9·30	32·76	24·0°	10·4°	0·0025	0·0060	0·8480	0·0140	0·8705	0·0272	Dark blue	Offensive	Offensive	Vegetable matter. Susp.
,, . . S.	68·60	12·39	33·70	19·0°	7·0°	0·0072	0·0045	0·4220	0·0080	0·4417	0·2500	,,	,,	Saline	,, ,,
Maryport . . M. W.	6·40	0·65	1·28	2·9°	2·1°	0·0027	0·0059	0·0500	0·0060	0·0646	0·1560	Green yell.	,,	Flat	Peaty contamination. Susp.
Newhaven . . P. W.	25·50	2·61	4·56	12·2°	4·5°	0·0019	0·0033	0·3920	traces	0·3972	0·0120	Pale blue	Flat	,,	Vegetable fibre
Pensarn . . M. W.	12·00	3·37	2·11	3·5°	3·2°	0·0025	0·0047	0·0420	,,	0·0492	0·0580	Green yell.	Offensive	Flat	Vegetable matter. Susp.
Portmadoc . . M. W.	3·40	0·40	1·64	1·4°	1·4°	0·0105	0·0054	0·0240	trace	0·0399	0·0640	Pale blue	Good	Good	Confervoid growths
,, . . F. W.	3·60	0·40	1·52	1·0°	1·0°	0·0093	0·0061	0·0280	,,	0·0434	0·1060	,,	,,	,,	Vegetable matter
Ramsey . . S.	5·34	1·13	1·98	1·4°	1·2°	0.0036	0·0120	0·0260	0·0020	0·0436	0·0780	Pale yellow	Offensive & flat	Offensive & flat	Satisfactory. Susp.
Rhyl . . M. W.	8·30	1·30	1·99	3·2°	3·2°	0·0022	0·0047	0·0520	trace	0·0589	0·1000	Dirty yell.	Decomposing veg.	Decayed leaves	Decomposing vegetable matter
,, . . S.	9·90	2·20	1·76	4·0°	4·0°	0·0023	0·0039	0·0800	0·0040	0·0896	0·0300	Yellow	Flat rain	Saline	Vegetable matter
St. Anne's . . M. W.	6·70	2·00	1·28	1·4°	1·4°	0·0026	0·0021	0·0130	0·0100	0·0277	0·1408	Orange yell.	Flat	Flat peaty	Vegetable matter
Sandown . . M. W.	18·00	5·03	4·45	6·4°	4·2°	0·0022	0·0379	0·0510	0·0050	0·0661	0·1400	Green yell.	Offensive	Offensive	Vegetable matter. Fe.
,, . . M. W.	15·40	0·99	4·61	7·3°	5·8°	0·0023	0·0042	0·0230	0·0050	0·0345	0·0540	,,	,,	,,	,, ,, bacteria, etc.
Seaton† . . M. W.	26·70	0·51	3·27	17·0°	5·2°	0·0026	0·0028	0·2060	0·0040	0·2154	trace	Good	,,	Satisfactory	Living organisms
Shanklin . . M. W.	24·60	3·08	4·45	12·8°	4·8°	0·0025	0·0019	0·0810	0·0030	0·0884	0·0100	Good	Good	Good	Bacteria, etc.
Sidmouth . . W.	28·60	2·58	4·91	10·8°	7·8°	0·0046	0·0029	0·1650	0·0030	0·1755	traces	,,	None	,,	,,
Southend . . M. W.	68·20	4·59	38·14	1·6°	0·2°	0·0116	0·0027	0·5600	0·0300	0·5943	0·0400	Good	Good	Saline	Satisfactory
Tenby* . . R. S.	12·20	3·16	2·57	5·7°	4·9°	0·0118	0·0151	0·0240	0·0040	0·0549	0·0480	Green	Peaty	Peaty	Bacteria
,, . . M. S.	13·50	2·89	3·62	4·4°	3·7°	0·0057	0·0064	0·0390	0·0030	0·0541	0·0840	Pale yellow	,,	,,	Bacteria and some diatoms. Susp.
Torquay . . M. W.	5·60	1·31	1·64	1·4°	1·2°	0·0088	0·0047	0·0790	0·0050	0·0975	0·1120	Good	Objectnble.	Satisfactory	Dcompsng leaves & veg. fibre. Susp.
,, . . R. S.	6·12	1·92	2·00	1·9°	1·9°	0·0118	0·0102	0·0670	0·0030	0·0920	0·0240	,,	Satisfactory	,,	Satisfactory
,, . . R. S.	19·50	4·02	1·76	10·2°	10·1°	0·0051	0·0063	0·0650	0·0050	0·0814	0·1640	,,	,,	,,	,,
Waterloo . . M. W.	24·30	0·90	4·45	8·0°	8·0°	0·0038	0·0030	0·3740	none	0·3808	0·0400	Pale blue	,,	Saline	Amorphous. Susp.
Weston-super-Mare . . M. W.	56·70	8·54	24·69	16·5°	15·0°	0·0035	0·0017	0·5180	trace	0·5232	almst none	,,	,,	,,	Vegetable contamination. Susp.
Westward Ho . M. W.	23·50	0·25	7·02	12·2°	3·9°	0·0033	0·0050	0·0260	0·0020	0·0363	0·0200	Pale yellow	Disagreeble	Disagreeble	Bacteria
Whitby† . . M. W.	10·60	0·54	1·99	9·4°	3·8°	0·0044	0·0037	0·0390	0·0030	0·0501	0·1122	Fair	Peaty	Peaty	Satisfactory

SERIES C.—Public Supplies of Third-Class Quality.

Name of Place Public Supply	Total Solids	Volatile Organic Matter	Chloride of Sodium	Hardness before Boiling	Hardness after Boiling	Nitrogen as free Ammonia	Nitrogen as Albd. Ammonia	Nitrogen as Nitrates	Nitrogen as Nitrites	Total Combined Nitrogen	Oxygen Absorbed	Colour	Smell	Taste	Microscope and General Remarks
Filey . . . M. W.	17·60	5·43	3·40	7·7°	5·5°	0·0040	0·0088	0·0410	traces	0·0538	0·0500	Dty opaque yellow	Very offensive urine	Flat	Unstsfctry. Susp.
Llandudno‡. . M. W.	31·70	9·83	6·90	8·8°	7·5°	0·0040	0·0035	0·2400	0·0040	0·2515	0·0140	Pale blue	Very offensive	Very offensive	,,
Saltburn § . . M. P.	10·30	6·00	2·22	3·8°	3·8°	0·0016	0·0050	traces	0·0030	0·0096	0·1930	Dirty brown	Offensive	,,	,, Susp.
Yarmouth† (Norfolk) M. W.	31·10	12·13	7·37	13·8°	8·6°	0·0046	0·0166	0·1472	0·0079	0·1763	0·1440	Dirty yell.	None	None	,, Susp.

The following three Public Supplies are, as will be at once seen from the figures, of such a quality that I have thought it desirable to distinguish them even from third-class waters.

Aldeburgh† . . P.	132·20	14·72	89·27	22·0°	10·0°	0·0017	0·0030	0·8650	0·0030	0·8727	0·0120	Strong blue	Offensive	Briny	Veg. contaminatn.
Harwich and Dovercourt† . . M. W.	120·80	10·38	92·43	25·0°	19·0°	0·0693	0·0044	0·4597	0·0060	0·5394	0·0064	Brownish	Free	,,	No organic matter Susp.
Walton-on-the-Naze . . M. W.	228·80	3·68	182·87	20·8°	7·2°	0·0020	0·0024	0·7696	0·0058	0·7798	0·1088	Fair	None	,,	Earthy matters. Susp.

With reference to those marked * I have analysed another sample which has appeared in the First-Class Table.
Those marked † have also a well supply, for which see Table of Results of Analyses of Samples from Wells.
With reference to those marked ‡ I have analysed two samples, one of which was Second-Class and the other Third-Class.
A sample from the place marked § is included in the First-Class Table.

SERIES C.—Well Supply.

Explanation.—The letters immediately following the name of the place indicate the person by or through whom the sample was obtained. W. means that it was obtained by myself or one of my assistants ; S., that it came from the Surveyor or Engineer or other local official ; P., that it has been privately forwarded by a resident or other person taking an interest in the subject. The results in the Microscope and General Remarks column are summarised as shortly as possible ; Susp. means suspended matter; Pb., lead ; Fe., iron when it exceeds mere traces.

Wells Name of Place		Total Solids	Volatile Organic Matter	Chloride of Sodium	Hardness before Boiling	Hardness after Boiling	Nitrogen as free Ammonia	Nitrogen as Albd. Ammonia	Nitrogen as Nitrates.	Nitrogen as Nitrites	Total Combined Nitrogen	Oxygen Absorbed	Colour	Smell	Taste	Microscope and General Remarks
FIRST-CLASS																
Alum Bay (Spring)	W.	39·00	0·37	12·05	17·3°	4·5°	0·0017	0·0040	0·0540	0·0020	0·0617	0·0620	Pale blue	Good	Good	Satisfactory
Beaumaris *	W.	18·00	2·19	2·57	7·6°	5·3°	0·0025	0·0020	0·2800	trace	0·2845	trace	,,	,,	,,	Satisfactory. Susp.
Glanrafon * (Spring)	W.	15·00	3·00	3·16	5·8°	5·8°	0·0042	0·0030	0·0570	0·0030	0·0772	,,	Good	Satisfactory	Satisfactory	Good
Lymington	W.	16·50	2·83	4·10	8·3°	6·10°	0·0035	0·0028	0·2210	0·0030	0·2303	0·0260	,,	,,	V. flat rain	Satisfactory
Pwllheli	W.	6·80	2·02	1·05	1·9°	1·5°	0·0178	0·0044	0·0530	0·0030	0·0782	0·0300	Pale blue	,,	V. flat s.	,,
,,	W.	11·20	2·00	5·85	2·7°	2·7°	0·0096	0·0037	0·0380	0·0040	0·0553	0·0100	,,	Flat and offensive	peaty	,,
SECOND-CLASS																
Bridlington *	W.	10·80	3·50	1·70	5·4°	5·2°	0·0056	0·0051	0·0100	0·0040	0·0847	0·0560	Dirty opaque yell.	Extremely objectionable	Most objectionable	,, Fe. Susp.
Carisbrooke Castle	W.	27·76	0·18	6·08	16·5°	4·4°	0·0030	0·0114	0·7620	trace	0·7764	0·0360	Yellow	None	S. saline	,,
Freshwater (River Yar)	W.	35·86	2·43	8·66	17·6°	4·8°	0·0040	0·0058	0·0700	,,	0·0798	0·1060	Pale green	Fair	Flat	Vegetable matter
Marske-by-the-Sea *	P.	58·06	3·32	15·44	16·9°	9·9°	0·0078	0·0062	0·1120	0·0030	0·1290	0·0100	Pale blue	Good	Good	Satisfactory. Fe.
THIRD-CLASS																
Abergele *	W.	106·60	13·20	26·91	34·0°	23·0°	0·0018	0·0106	3·7400	0·0040	3·7564	0·0780	Pale green	Satisfactory	S. saline	Decomposing animal matter, and large number of crystals of urates
Aldeburgh * (Town)	P.	59·40	8·43	19·25	24·5°	14·8°	0·0067	0·0080	1·7600	traces	1·7731	0·1000	Yellow	Offensive	Offensive	Monads, bacteria, and vibrions and animal remains
Bognor (Hotel)	W.	65·40	3·40	16·38	36·8°	17·7°	0·0032	0·0025	1·9200	0·0030	1·9287	0·0140	Pale blue	Fair	Fair	Living animalculæ and other organic impurities
,, (House)	W.	48·00	3·42	10·65	19·4°	9·9°	0·0138	0·0138	1·3270	0·0030	1·3676	0·1900	Urine yell.	Offensive	Offensive	Decomposing muscular fibre and other organic impurities. Susp.
Clacton (Hotel)	W.	48·60	7·51	11·58	12·0°	6·8°	0·0024	0·0060	1·0740	0·0110	1·0934	0·1120	D. brown	,,	,,	Decomposing muscular fibre and hairs. Susp.
,, (Shop)	W.	42·00	9·28	12·49	10·4°	8·3°	0·0044	0·0060	1·1516	0·0030	1·1650	0·0740	Pale blue	Fair	Fair	More satisfactory than hotel sample. Fe. Susp.
Cromer (Town pump)	W.	146·70	29·62	48·91	54·4°	40·8°	0·0018	0.0076	5·9500	traces	5·9594	0·0720	Yell. green	Very offensive	Nauseous	Animalculæ — crystals of urea
,, (Baker's pump)	W.	32·10	10·07	5·73	13·5°	7·3°	0·0036	0·0095	1·2600	,,	1·2731	0·1040	Dirty	Offensive	Putrid	Animalculæ
,, (Shop)	P.	39·80	3·20	6·90	19·9°	9·9°	0·0016	0·0055	1·6000	,,	1·6171	0·0700	D. green	,,	V. nauseous	Susp.
Dawlish (Hotel)	W.	34·20	4·64	8·85	8·9°	6·8°	0·0161	0·0033	0·5830	0·0050	0·6074	0·0160	Green	None	S. objectble.	Unsatisfactory
,, (Shop)	W.	30·80	4·76	7·60	8·2°	7·2°	0·0049	0·0028	0·7660	0·0040	0·7777	0·0160	—	—	—	,,
Filey * (Hotel)	W.	206·40	27·52	62·71	64·0°	22·0°	0·0044	0·0143	5·9400	0·0090	5·9677	0·3220	Dirty urine yellow	Sewage	Sewage	Crystals of urea and urate of potash. Fe., Susp., Pb., and Cu.
Freshwater (Hotel)	W.	138·00	10·22	110·57	15·4°	6·4°	0·0028	0·0019	0·0700	trace	0·0747	0·1820	Dirty yell.	Bad	Briny	Decomposing organic matter. Fe.
Harwich * (Brrck. pmp)	W.	61·40	14·40	12·87	36·0°	27·0°	0·0064	0·0062	1·7380	0·0060	1·7566	0·0448	Pale yellow	Offensive	Offensive	Vegetable matter. Susp.
,, * (Trrce. pmp)	W.	109·40	24·40	36·62	57·0°	47·0°	0·0044	0·0040	1·5824	0·0072	1·5980	0·0096	Pale blue	None	Soapy and alkaline	Satisfactory. Susp.
,, (Private)	W.	81·30	20·46	20·38	30·0°	24·0°	0·0016	0·0035	3·2120	0·0030	3·2221	0·0032	,,	S. urine	Objectionable	Organic contamination. Susp.
Herne Bay	W.	57·90	5·70	17·80	14·0°	13·0°	0·0300	0·0057	trace	0·0200	0·0557	0·0416	Milky	Milky	Saline	Satisfactory. Susp.
Hornsea (Public)	P.	84·60	10·00	15·91	32·0°	12·0°	0·0030	0·0099	1·8200	trace	1·8329	0·0060	Good	Offensive	Offensive	Much vegetable contamination
Kingskerswell	P.	67·40	2·22	12·87	28·4°	8·9°	0·0057	0·0045	1·6760	0·0040	1·6902	0·0400	Yellow	None	None	Swarming bacteria and decomposing animal *débris*
Littlehampton	W.	79·80	11·60	14·63	28·0°	21·5°	0·0063	0·0141	3·4300	0·0020	3·4524	0·0300	Pale blue	Fair	Offensive	Unsatisfactory. Susp.
,,	W.	112·00	17·38	56·95	22·5°	12·0°	0·0041	0·0048	0·9700	0·0010	0·9799	0·0600	Dirty yell. green	,,	Saline	L. organisms, pieces of skin, and organic remains of every kind. Susp.
Lowestoft * (Hotel)	W.	141·80	28·50	59·67	52·0°	42·0°	0·0291	0·0158	5·4604	0·0064	5·5117	0·1200	Urine yell.	Offensive	,,	Full of urine salts and epithelial mtr. Fe. Susp.
Lymington (Hotel)	W.	63·10	12·01	16·38	19·7°	12·0°	0·0066	0·0054	1·3300	traces	1·3420	0·0760	Yellow	,,	Offensive	Variety of living animalculæ
Marske-by-the-Sea *	P.	79·80	6·69	20·21	19·0°	14·2°	0·0072	0·0044	0·0570	0·0030	0·0716	0·0100	S. ,,	Satisfactory	Saline	Vegetable matter
Newhaven	W.	73·40	5·39	22·23	26·3°	7·2°	0·0020	0·0027	0·7000	—	0·7047	0·0120	Good	,,	Satisfactory	Much bacteria and unsatisfactory matter
,,	S.	46·80	0·82	13·46	17·8°	7·4°	0·0017	0·0033	0·6300	traces	0·6350	0·0040	Pale blue	Flat	Good	Vegetable fibre
Ogwen Lake *	W.	25·40	7·40	5·85	10·8°	10·8°	0·0115	0·0043	0·8370	,,	0·8528	0·0100	,,	,,	,,	Much vegetable matter. Pb. and Cu.
Paignton *	W.	27·90	0·14	4·47	16·1°	6·1°	0·0060	0·0054	0·4160	0·0040	0·4314	0·0120	Bad	Bad	Bad	Full of bacteria and other forms of life, and decomposing organic matter. Susp.
Rottingdean (Church pump)	P.	58·10	4·17	24·97	18·6°	7·4°	0·0009	0·0028	1·1340	trace	1·1377	0·0160	Green	Sulphuretted hydrogen & exc.	Sulphuretted hydrogen & exc.	Hairs, cotton fibre, and other organic remains. Fe. Susp.
,, ,,	S.	56·81	4·13	24·57	18·7°	9·9°	0·0035	0·0043	1·2990	0·0020	1·3098	0·0360	,,	,,	,,	Hairs, cotton fibre, and other organic remains. Susp.
,,	S.	401·00	31·23	323·51	30·6°	16·1°	0·0175	0·0050	1·6100	trace	1·6325	0·0240	,,	Offensive	Saline and offensive	Animal remains entangled in crystals. Susp.
Sandwich (Market pump)	W.	103·00	11·30	29·07	36·0°	19·0°	0·0029	0·0270	4·1300	0·0040	4·1639	0·0540	Dirty opaq. yellow	Fair	Free	Unsatisfactory
,, (Stream)	W.	21·60	4·42	3·51	12·1°	3·5°	0·0080	0·0061	0·2070	0·0030	0·2241	0·0420	,,	Objectionable	Objectionable	,, Susp.
Seaford (Filtered)	P.	113·05	23·60	44·93	23·0°	13·0°	0·0017	0·0033	2·7070	0·0040	2·7160	0·0140	Pale blue	None	Offensive	Satisfactory
,, (Unfiltered)	W.	101·00	9·24	44·23	29°	10°	0·0021	0·0036	1·8300	traces	1·8957	0·0060	Fair	Very offensive	Very offensive	Swarming with living animalculæ and decomposing animal remains
,,	W.	87·20	8·50	37·32	25·7°	13·2°	0·0020	0·0030	1·3300	,,	1·3350	0·0160	,,	Offensive	Saline	Full of living organisms
,,	W.	121·20	20·26	76·40	18·6°	8·5°	0·0020	0·0026	0·9800	,,	0·9848	0·0140	,,	Fæces	,, and fæces	Urinary salts
Seaton	W.	46·42	0·15	16·97	17·2°	8·0°	0·0019	0·0049	1·5350	0·0050	1·5468	0·0680	Pale yellow	None	None	Satisfactory
,,	W.	76·20	14·98	17·61	23·0°	13·4°	0·0030	0·0078	2·1370	0·0050	2·1528	0·0120	,,	,,	Salt	Unsatisfactory
Walton-on-the-Naze *	W.	61·60	12·63	19·30	22·0°	13·2°	0·0016	0·0076	2·1240	0·0080	2·1412	0·0430	Yell. green	Offensive	Offensive	Numerous living organisms. Fe. Susp.
(Turpin's pump)	W.															More satisfactory than Turpin's Pump. Fe. Susp.
,, (Walford's pump)	W.	31·50	7·74	13·22	14·0°	13·4°	0·0024	0·0107	0·4550	0·0100	0·4781	0·1184	Green	Unpleasant	Unpleasant	Remains of organic matter. Susp.
Wells	W.	85·20	13·90	17·73	36·0°	31·0°	0·0044	0·0082	2·6152	0·0086	2·6364	0·0560	Yell. green	Good	Good	Particles of vegetable tissue
,,	W.	49·70	11·54	7·37	24·0°	15·0°	0·0026	0·0036	1·4094	0·0058	1·4214	0·0384	Pale yell.	,,	,,	,, ,,
Whitby *	W.	65·10	18·18	18·08	21·0°	13·8°	0·2240	0·0600	0·8220	0·0180	1·1240	0·6440	Filthy brwn	S. offensive	S. offensive	Susp. 15 grs. per gall.
Yarmouth, I. W.	W.	67·46	5·86	19·95	26·6°	7·0°	0·0015	0·0043	1·6100	traces	1·6158	0·0560	Good	Flat	Sulphuretted hydrogen & sal.	Organic contamination. Fe.
Yarmouth, Norfolk * (Denewell)	W.	112·10	18·82	41·07	34·0°	33·6°	0·0275	0·0119	4·1973	0·0089	4·2461	0·0920	Pale urine yellow	Offensive	Offensive	Urate of ammonia and soda, and animal tissue. Susp.
,, ,, (Church pump)	W.	75·60	17·30	15·91	30·6°	29·0°	0·0012	0·0108	1·3491	0·0079	1·3690	0·1260	S. ,, ,,	,,	,,	Animal fibre and living organisms. Fe. Susp. Pb. and Cu.

Those marked * have also a Public Supply.